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ALPHABETICAL INDEX ON LAST PAGE!

BUYERS!—Refer to our Classified Index of Articles Advertised on last few pages

THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power; and to the operation of Refrigerating Machinery.

Published by The MacLean Publishing Co., Limited.

MONTREAL: Eastern Townships Bank Bldg. TORONTO: 143 149 University Ave. LONDON, ENG.: 88 Fleet St. E.C. WINNIPEG: 34 Royal Bank Bldg.

Vol. VI. Publication Office, Toronto—January, 1913 No. 1

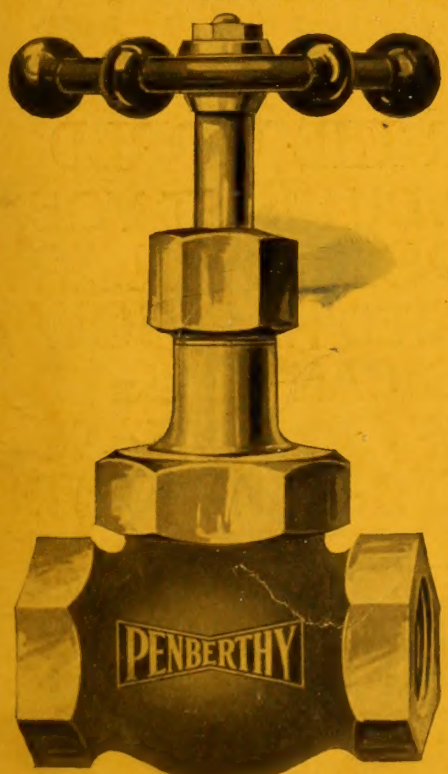
TRADE PENBERTHY MARK

REGRINDING BRASS VALVES

"THE ALL QUALITY LINE" that will give

A LIFETIME EFFICIENCY

Guaranteed to stand a constant working pressure of 200 lbs.



Regrinding Globe Valve

Regrinding Horizontal Check

Regrinding Swing Check

Regrinding Angle Check

Regrinding Vertical Check

Our Valves are Absolutely Dependable

They are made of the best grade of material and by men who know how to make good valves. They are economical for they require no new extra parts when the seats become worn. The simple method of regrinding puts the valve back into as good condition as when new.

Write us for interesting booklet to-day.

Penberthy Injector Co., Limited Windsor, Ont.

ECLIPSE SECTIONAL RAINBOW GASKET

YOU WILL FIND IT ALL OVER THE WORLD

WHEREVER PACKING IS SOLD. IF YOU INSIST YOU CAN SECURE THE GENUINE ECLIPSE TUBULAR GASKETS MADE OF THE CELEBRATED RAINBOW COMPOUND. THESE GASKETS CAN BE USED OVER AND OVER, AND THE USE OF SAME MEANS ECONOMY IN THE ENGINEERING DEPARTMENT.

MANUFACTURED EXCLUSIVELY BY

PEERLESS RUBBER MANUFACTURING COMPANY

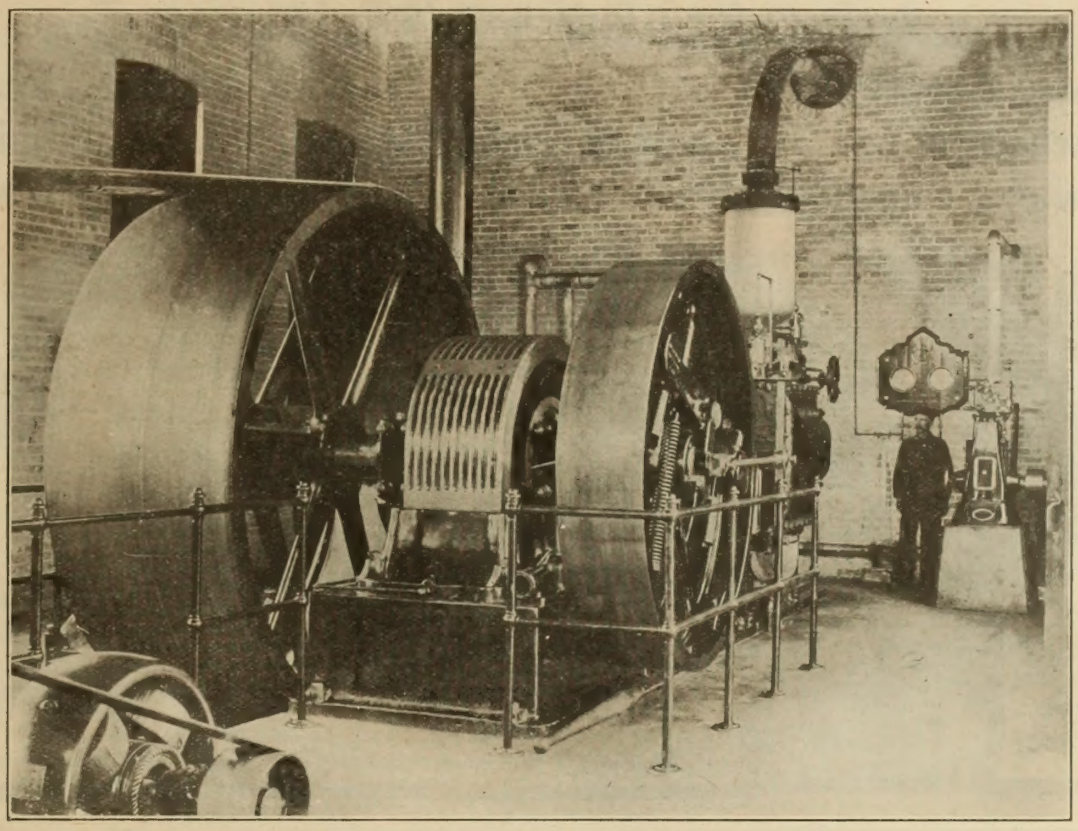
16 WARREN STREET, NEW YORK

H. D. EDWARDS & CO.

DETROIT, MICH.

Sole Agents and Distributors for the Dominion of Canada.

"Continuous Service for the Isolated Plant"



McEwen High Speed Automatic Engines

The McEwen Engine in your plant means economy in steam consumption, a great range of power at command, and absolute reliability under all conditions.

To make this possible the McEwen combines simplicity and accessibility of all parts, great strength in construction, and a guaranteed regulation by one of the best automatic fly wheel governors—the Begthrup—on the market to-day.

The McEwen Engine is particularly adapted for producing electric light and power economically. In this class of work its ability to absorb overload and its instantaneous regulation make it an ideal installation. Hundreds of isolated plants in Canada testify to this.

Built in simple and compound units up to 700 H.P. Let us send you our catalogue and list of Canadian users. *It will convince you.*

The Waterous Engine Works Co., Limited

BRANTFORD, CANADA

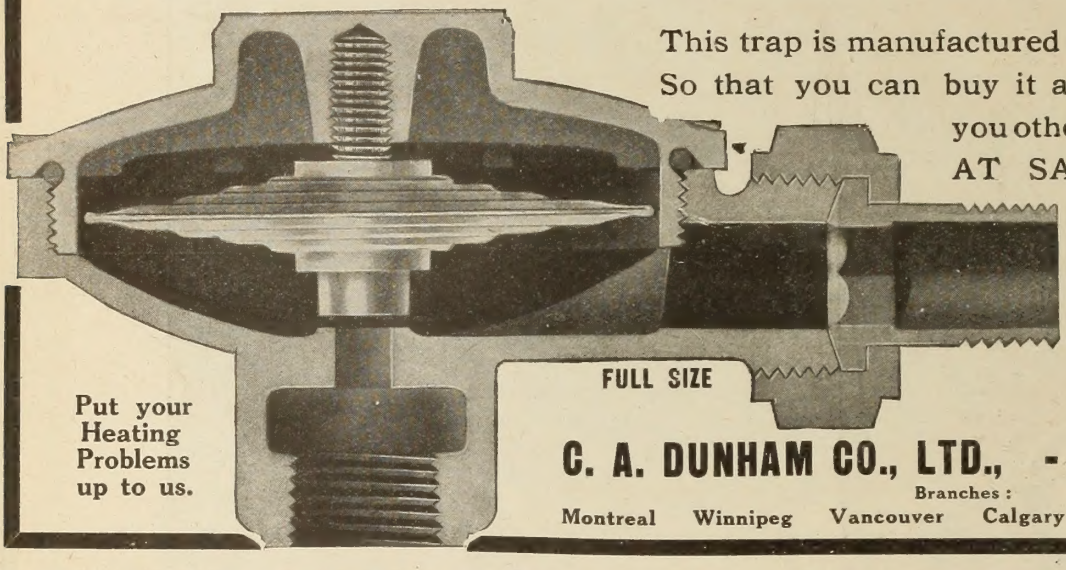
The advertiser would like to know where you saw his advertisement—tell him.

Dunham Radiator Steam Traps

Perform their Duties at 100% Efficiency

It always opens for air
It always opens for water
It always closes against steam

Insuring perfect circulation of steam. Eliminating possibility of any freeze up.



FULL SIZE

This trap is manufactured in Canada. Why? So that you can buy it at 30% cheaper than you otherwise could. SOLD AT SAME PRICES AS IN UNITED STATES.

Catalogue Free

Put your Heating Problems up to us.

C. A. DUNHAM CO., LTD., - TORONTO, CAN.

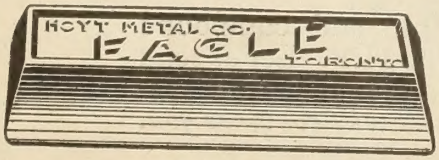
Branches:
Montreal Winnipeg Vancouver Calgary Edmonton Lethbridge

Sales Over Five Million Dollars Annually

Four Babbitt Manufacturing Plants

TORONTO LONDON, ENG. NEW YORK ST. LOUIS

Faultless "A" This babbitt is a high grade copper hardened alloy, possessing in a higher degree all the good points of the original Genuine Babbitt, with increased antifriction qualities, having the additional merit of absorbing and holding oil. It is used extensively in France for automobile engines, and in South Africa for mining machinery, and in United States and Canada for marine engines, dynamos and all heavy duty machines. Where heavy service is required this will last longer than any Genuine Babbitt manufactured. For heavy duty, saw mills and engines it is without equal.



Eagle "A" Thousands of tons of this alloy have been placed on the market, giving such perfect results, that it's name and merits are known, we believe, as extensively as any other babbitt manufactured. Its high antifriction and heavy duty qualities make it especially adapted for saw-mills, planing-mills, threshing engines, traction engines, pumps, rolling-mills and general machine shop use.

HOYT METAL COMPANY

TORONTO OFFICE AND MFG. PLANT—EASTERN AVE. AND LEWIS ST.

The advertiser would like to know where you saw his advertisement—tell him.

Buy the BOILER

That Will Prove a Good Investment--Not a Loss

You should exercise great care in the selection of boilers—you should find out what they are doing for other plants in your vicinity. There are many users of

JENCKES BOILERS

who will gladly give you all the information you desire. Why not benefit by the experience of others—it will cost you nothing outside of a two cent stamp, and you will be certain of the same results in your plant—you will be confident that your boiler is built right.

A poor boiler needs much attention, and is less durable, although about the same in price.

Jenckes Boilers are made by skilled workmen from the best materials procurable. They minimise the stoppage for repairs. They are built to give long service, and to conform to the various Provincial Inspection Acts.

We manufacture **Tubular, Locomotive or Vertical Boilers, and contract for complete steam plants.** A well assorted stock of boilers on hand constantly.

Write for catalog and list of users.

The Jenckes Machine Co., Limited

Sherbrooke Montreal St. Catharines Cobalt South Porcupine Nelson Vancouver

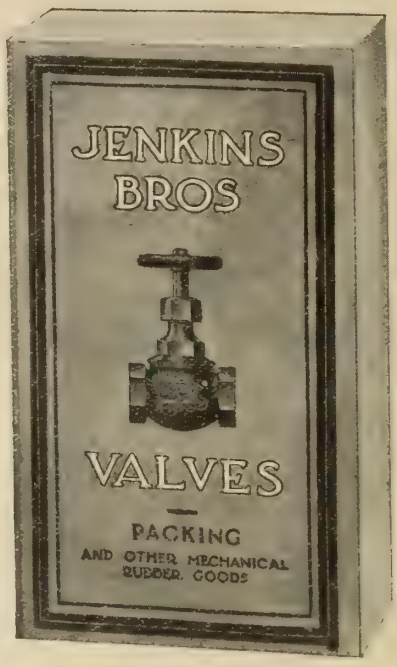
Works: SHERBROOKE, QUE., ST. CATHARINES, ONT.

TRADE JENKINS MARK
Jenkins Bros

Here's a Catalog

You Ought to have—

The new Jenkins Bros. Catalog for 1912



It shows some new types of valves, including the new TYPE "K" brass and iron body gate valves; cast steel valves of extra heavy patterns for superheated steam and hydraulic service, extra heavy check and blow-off valves, automatic equalizing stop and check valves, additional styles of radiator valves—

As well as the standard Jenkins Bros. types you have known and used for years.

Compact—handy—brimful of information for the man who's interested in valves, packing and other mechanical rubber goods for the power plant.

Send for your copy to-day.

Jenkins Bros., Limited

103 ST. REMI STREET

MONTREAL

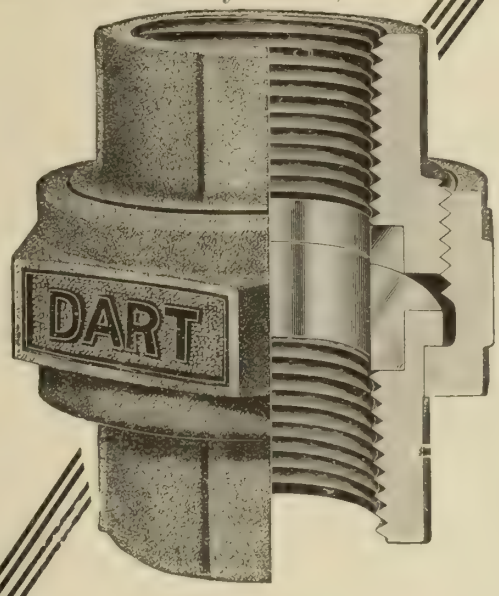
DART UNIONS

Eliminate Trouble and Expense

When a **Dart Union Pipe Coupling** is connected it forms a joint that stays tight until deliberately loosened with a wrench.

It has a **Bronze to Bronze Ball Shaped Joint** which permits connections to be easily made, whether pipes are in or out of line.

The joint cannot rust or corrode, and will never leak unless abused. The heavy iron parts do not expand or contract — they insure durability and long service.



BRONZE TO BRONZE
At the Joint

Dart Unions can be connected and disconnected time after time without impairing their efficiency.

They save money because they never need to be replaced, and are never troublesome.

If you are not familiar with the Dart, let **us connect you with some users**—their verdict will convince you that this union gives economical and reliable service.

Dart Unions are made in all convenient types.

Your jobber has them.

Dart Union Co., Limited TORONTO, CANADA

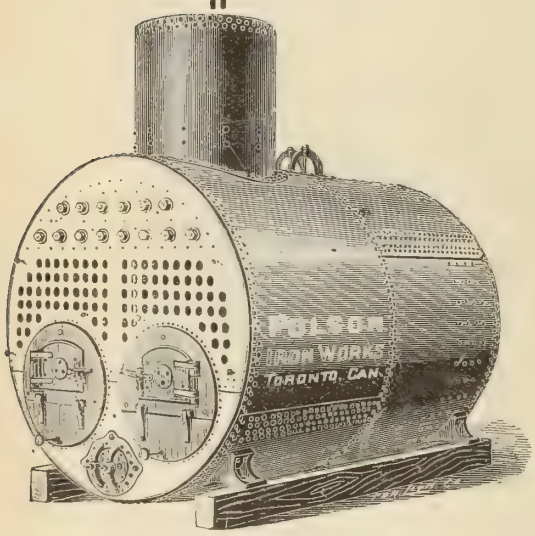
The advertiser would like to know where you saw his advertisement—tell him

MARINE BOILERS

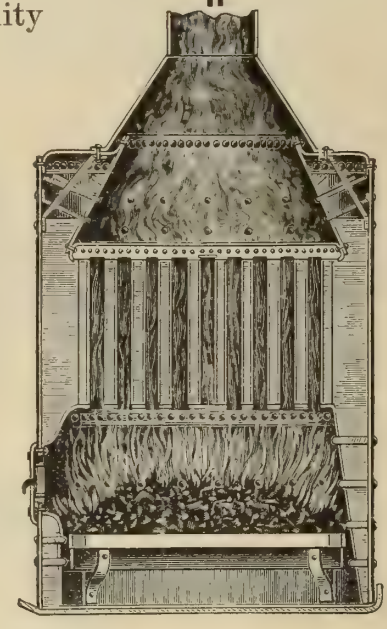
LAND BOILERS

The Utmost in Boiler Efficiency

From start to finish these boilers are under the supervision of experts, and are made by men with long experience. Only the best materials are used, so as to ensure a boiler of unusual durability and safety.



It will pay you to communicate with us and get full particulars. You may need a new boiler soon, and you will want the best.



We build various types:

Scotch, Clyde, Fitzgibbon, Vertical, Mosher.

Horizontal Tubular, Vertical, Locomotive Type, "Heine" Water Tube

GENERAL PLATE WORK

POLSON IRON WORKS, LIMITED

STEEL SHIPBUILDERS, ENGINEERS AND BOILERMAKERS

TORONTO **CANADA**

REPRESENTATIVES IN CANADA FOR

The B. F. Sturtevant Co., Hyde Park, Mass., U.S.A., Fans, Blowers, Heating and Ventilating
The John I. Thornycroft Co., London, England, Marine Motors

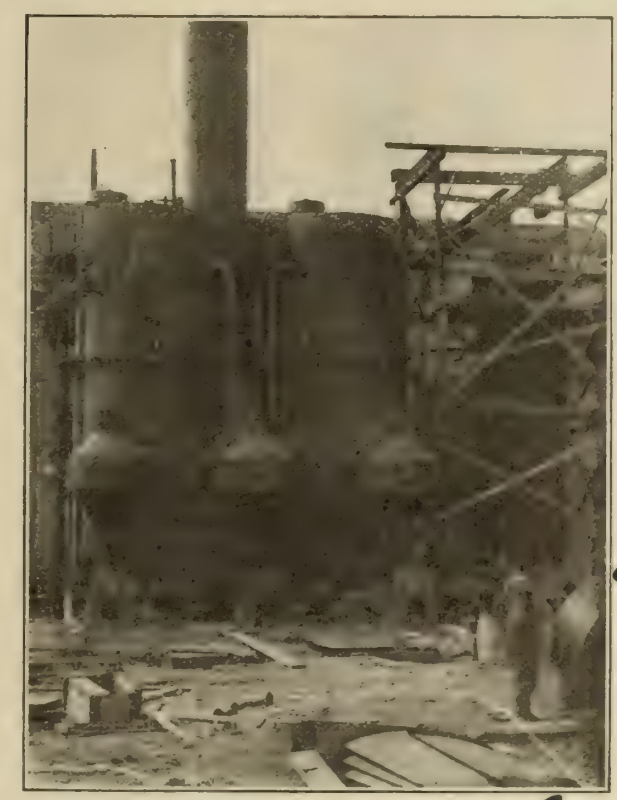
The advertiser would like to know where you saw his advertisement—tell him.

BETTINGTON BOILERS

How much does it cost you for steam?
How much fuel remains in your ash?
How much unconsumed volatile is going up your stack?
If you are burning slack coal are you obtaining the maximum evaporation from it?

REASONS WHY THE BETTINGTON SYSTEM WILL CUT DOWN YOUR FUEL BILLS.

1. Analysis of the ash shows no carbon.
2. Volatile is all consumed.
3. Cheap coal containing as high as 35% ash can be burned with the highest efficiency.
4. Stand by losses eliminated.
5. The cheapest grades of coal can be used.
6. Less labor required.



Bettington Boilers in course of erection for Dominion Coal Co., Ltd.

OPERATING ADVANTAGES OF THE BETTINGTON SYSTEM.

1. No grates.
2. No fires to clean.
3. Less ash to handle.
4. Fuel supply quickly adjusted to demand for steam.
5. No smoke.
6. No stand by boilers with banked fires necessary to take care of peak loads.
7. Full load can be obtained in 30 minutes from a cold boiler.

THE BETTINGTON SYSTEM of burning pulverized fuel gives all the advantages of gas fired boilers, and 80% thermal efficiency with the cheapest fuel can be continuously obtained.

FRASER & CHALMERS
LIMITED

Canadian Branch:
4 PHILLIPS PLACE, - - MONTREAL, P.Q.

The advertiser would like to know where you saw his advertisement—tell him.

QUAKER CITY RUBBER COMPANY | QUAKER CITY RUBBER COMPANY | QUAKER CITY RUBBER COMPANY

Makes Rods as Smooth as Glass

The high grade lubricants used in P.P.P. fill up the microscopic depressions in piston rods and make them as smooth as glass.

Daniel's P. P. P. Rod Packing

gives and takes with the requirement. The bearing on the rod is just enough to keep it steamtight—never too much, always enough. There is no need to use a wrench to tighten the gland nuts—simply use your fingers. P.P.P. lasts for months—frequently more than a year. It positively creates no unnecessary friction. P.P.P. is the only packing that works successfully on scored rods. Your dealer should have P.P.P., if he doesn't keep it, send us his name and address.

Free—"The Slide Valve" Send for a Copy

This book will tell you a lot of things you need to know about the slide valve. The engineer who gets big pay is the engineer who knows. The book contains many illustrations, diagrams, etc., substantially bound; fits your pocket. You must act quickly if you want a free copy. There will be no more when the present edition runs out.

Positively the book will not be sent unless the coupon is fully made out and returned to us.

How To Get The Valve Book FREE

Fill out the Coupon, and mail it to us. We will address a book to you, and send it to your dealer, who will hand it to you, FREE of charge, when you call at his store and look at Daniel's P. P. P. Packing.

Your Name? .....
Address .....
Employed by .....
Address .....
Horsepower of Engine .....
Kind of Rod Packing Used .....
Do you use EBONITE Sheet Packing? .....
Dealer's Name .....
Address ..... Series 24 L-V
Name of Buyer .....

If your dealer doesn't carry P. P. P. we will write telling you who does, and the book will be sent to the dealer we name. Please do not call for book until we notify you.

FREE to Users of P.P.P.

If you are a user of Daniel's P.P.P., fill out the coupon and mail it to us with the Big Red D—cut from the box lid—and a **testimonial letter** of your experience with the packing. We will mail you a FREE copy of "The Slide Valve" direct. You'll not be required to go to your dealer for the book. Don't forget the letter.

QUAKER CITY RUBBER COMPANY

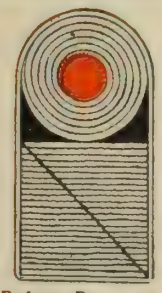
Manufacturers of Mechanical Rubber Goods
PHILADELPHIA, PA., U.S.A.

The Seal of Quality

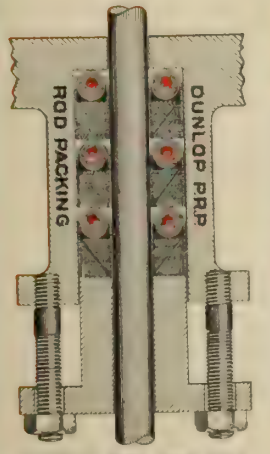
DUNLOP PISTON ROD PACKING

Works Equally Well on a Heavy Pump, as on the Most Sensitive Valve Stems

It is the only packing that is an absorbent of the lubricants, insuring a film of oil on the wearing surface and adapting itself to all conditions of the rod and of the stuffing box. It is the only self-setting packing, the wedges being operated by the pressure from the cylinder, producing on the rod the smallest amount of friction during only a portion of each revolution, hence saving in fuel is many times the cost of the packing.



Before Pressure



Stuffing Box and Rod with Packing in, and gland adjusted.

Dunlop Piston Rod Packing

is impervious to the action of steam, oils, acids, alkalies, and sulphurous waters, and eliminates the loss of ammonia in the ice-making machine. On the steam hammer there is no indication of "drip," and it is not affected by the vibration of the rod, the packing being self-adjustable.

When in the market for Packing, Belting, Hose, Valves, etc., consult us. We make a suitable article for every specific purpose. If you purchase our line you will be one of the many who realize that fact.

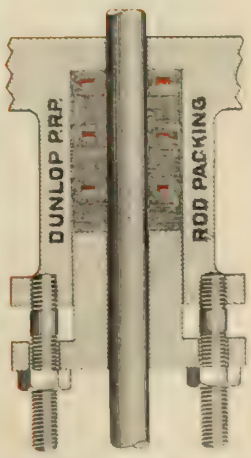
OUR "TWO HANDS" TRADE MARK IS YOUR PROTECTION—always look for it.

Dunlop Tire & Rubber Goods Co., Limited

Head Office and Factories : TORONTO

Branches : Victoria, Vancouver, Nelson, Edmonton, Calgary, Regina, Winnipeg, London, Ont., Hamilton, Toronto, Ottawa, Montreal, St. John, N.B.

Under Pressure



Stuffing Box and Rod showing Packing under Pressure

You Can Dodge a Lot of Trouble Next Year

by using Goetze Elastic Corrugated Copper Gaskets with Asbestos Lining No. 2 in every flanged joint in your plant.

By starting right now to renew with these gaskets, you can steadily reduce your renewals till you've brought them almost to the vanishing point.

That sounds almost too good to be true, but nevertheless it is true. We can prove it by unimpeachable evidence from almost any part of the wide world where steam is used for power.

We can prove it in your own plant, and we will, if you say so, by sending you Goetze Gaskets for ninety days' trial on the very joints that have given you the most trouble. If we don't prove it, and to your complete satisfaction, you needn't pay us a cent.

Think what it means to regasket a joint that you've never been able to keep tight for more than a few days or weeks, and know that you can forget that joint for years.

Think what that means in the saving of fuel, of labor, of gasket costs and shut-downs. And think what all these mean when translated into dollars.

And then don't think you'll try them "some day," because there will never be so good a time to begin building bigger profits in 1913 as right now.

Send your trial order (no matter how small) today, for we wish you a Happy and Prosperous New Year, and want to do what we can to help you in that direction.

It will pay you to get acquainted with Goetze No. 2 Efficiency, to learn the difference between an ordinary Gasket and a No. 2 Gasket.

Goetze Gaskets are carried in stock by

T. McAVITY & SONS, LIMITED

St. John, N.B.

BRANCHES AT

MONTREAL
70 Cedar Ave.

WINNIPEG
C. E. Chown, 147 Bannatyne Ave.

VANCOUVER
A. O. Campbell, 1069 Hamilton St.

MANUFACTURED BY

Goetze Gasket & Packing Co.

NEW BRUNSWICK, N.J.

The advertiser would like to know where you saw his advertisement—tell him.

TRADE THE GARLOCK PACKING CO. HAMILTON, CANADA. MARK

GARLOCK PACKINGS

On account of their superior qualities, are recognized as a standard packing for use under all conditions of service. Our Trade-mark is the passport by which we are known to those in need of reliable goods.

We have Packings to meet every requirement, and all you have to do is to write for information.

Garlock High Pressure Ring

Our handsomely illustrated catalog, descriptive of Garlock Packings and Pipe Coverings, will be mailed on request.

Garlock Asbestos Gasket

"PIONEERS IN THE PACKING BUSINESS."

The Garlock Packing Co.

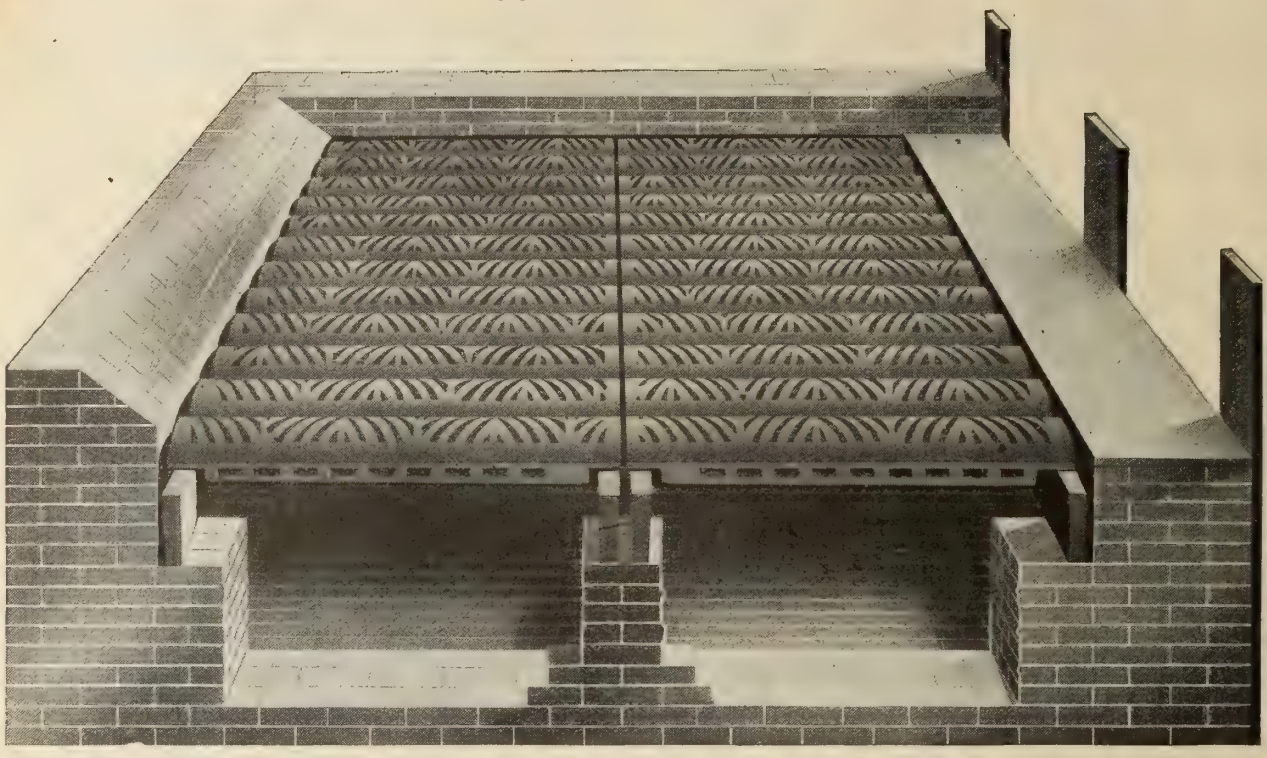
Head Office and Works: HAMILTON, ONT.

Branches: MONTREAL, QUE., 412 St. James Street.
TORONTO, ONT., 77 Adelaide Street East.
WINNIPEG, MAN., 117 Market Street East.

THOMAS ELLIPTIC GRATE BARS

SHAKING—CIRCLE—STATIONARY

FOR EVERY FUEL



THOMAS IDEAS

PATENTED

THOMAS ELLIPTIC GRATE BARS	INCREASE STEAM—SAVE FUEL—SAVE LABOR —COST LESS—REDUCE SMOKE.
THOMAS GRATE RESTS	EVERLASTING—PRESERVE GRATE BARS—PROTECT FIRE WALLS.
THOMAS FURNACE SETTING	FIRE WALLS—BRIDGE WALL—FRONT WALL independent of all expanding and contracting irons. SEE THAT AIR SPACE COMPLETELY ENCIRCLING THE GRATE AREA. No dead and burned grate bar ends. No pushed down walls from expansion of grates.

Shipped from Hamilton, Ont. **Let us give you complete information.**

FOR ALL PROBLEMS

Steam—Grate Bar—Furnace—write THOMAS

The General Supply Co. of Canada, Ltd.

OTTAWA TORONTO WINNIPEG

THOMAS GRATE BAR CO., **Birmingham, Ala., U.S.A.**

Fuel Expense High?

It can be Greatly Reduced by Using

"THE Cyclone"

Shaking and Dumping Grate Bar

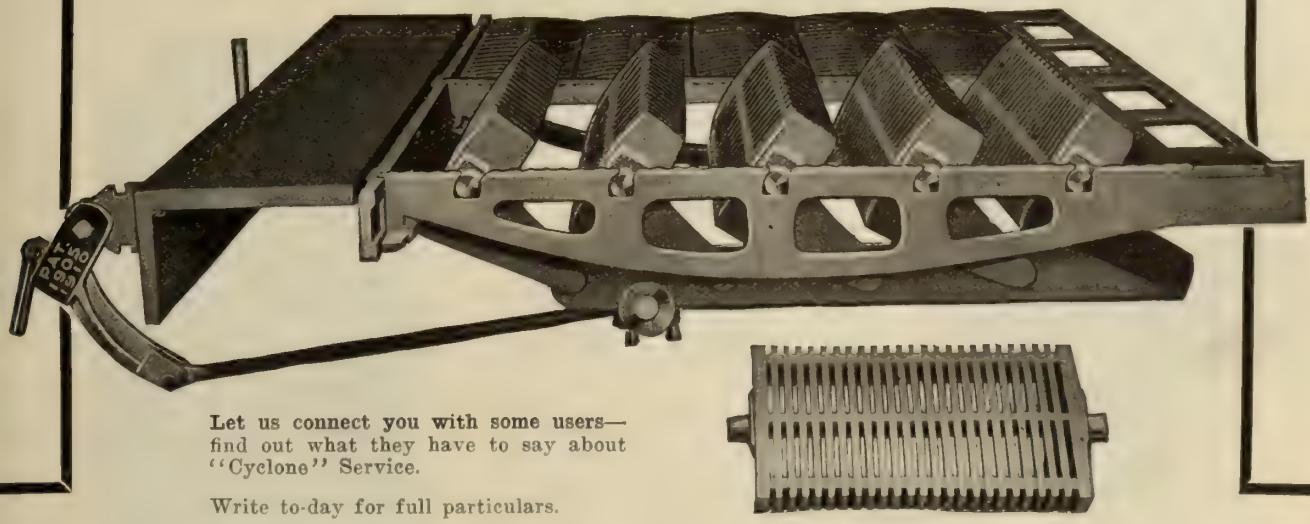
Because You Can Burn The Cheapest Grades Of Fuel With Results Equal To That Of The Best

"The **Cyclone**" is the one grate that locks level, cannot get out of adjustment or become warped. It allows 68 per cent. air space and 90 per cent. draft and gives perfect combustion. Burns cheap fuels such as soft and hard coal screenings, coke breeze, hard and run of the mine coal.

"The **Cyclone**" Bar is built to get rid of the ash. It **has an improved mechanism,** which means more vigorous and effective shaking and prevents any ashes or clinkers from clinging to the centre of the grate.

This grate Bar has been **time tried and tested by actual service,** and has been endorsed by those who know, as the most economical ever produced.

"**The Cyclone**" is imitated in design and construction, but is far from being equalled in quality—**beware of imitations.**



Let us connect you with some users—find out what they have to say about "Cyclone" Service.

Write to-day for full particulars.

CANADIAN STEAM BOILER EQUIPMENT COMPANY, Ltd.

SOLE MANUFACTURERS FOR CANADA

211 QUEEN STREET EAST :-: :-: :-: **TORONTO, CANADA**

AGENTS

ST. JOHN, N.B., F. W. Blizard, Canada Permanent Chambers. MONTREAL, H. L. Peiler & Co., 308 St. James Street.
HAMILTON, Robt. Fitzsimmons, 8 Grove Street. CALGARY, Alta., The Western Foundry & Metal Co., Limited.
BERLIN, J. Hainsworth, 14 Foundry Street. WINNIPEG, Vulcan Iron Works.

The advertiser would like to know where you saw his advertisement—tell him.

SAVE 50%

By Using
GREASE AS A LUBRICANT
In The

"PHILADELPHIA" GREASE CUP

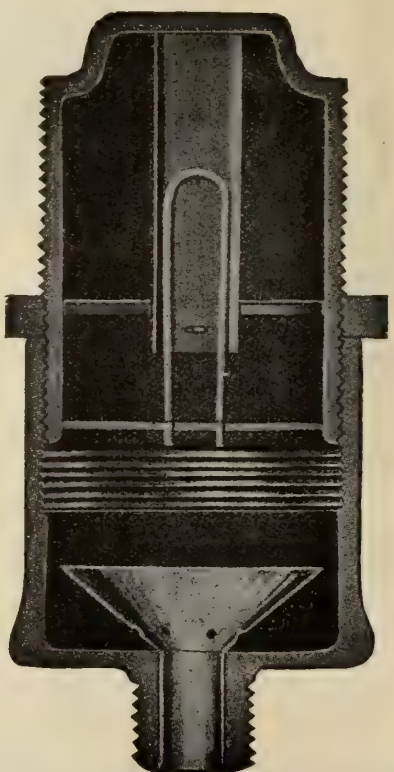
Automatic Feed Under Compressed Air
Slow And Continuous
No Oil Drips—Reduced Fire Hazard

Unexcelled for Lubricating Loose Pulleys, Crank Pins and all classes of Extremely High Speed and Heavy Running Machinery.

In the "Philadelphia" Grease Cup System of lubricating there is no friction, no piston or spring is used, just a thin metal disc resting lightly on the grease to keep it level.

Air pressure above and the needs of the journal below are all that is required to give perfect lubrication. Grease does not change in the slightest, while in the "**Philadelphia**" **Cup**; the last drop is as good as the first.

There is a large unrestricted outlet and a regularity of action which permits feeding of grease of any thickness.



We guarantee a saving of at least 50% over any other system. You must be perfectly satisfied before you pay a cent.

Our Booklet tells more about it — write to-day.

Peterborough Lubricator Mfg. Co., Limited

PETERBOROUGH, ONTARIO

PROFESSOR STRIBECK

THE GREAT GERMAN AUTHORITY TESTED MAGNOLIA METAL

AT THE CENTRAL TECHNICAL EXPERIMENTING ESTABLISHMENT, NEW BUBLESBERG

His report of this test was voluminous and there were fourteen diagrams, therefore we can only give in this limited space his

"CONCLUSION"

"The Magnolia Metal Bearing ran itself rapidly and well into good working order with the **thin** Velocity Spindle Oil. Under pressures for which this oil was too thin and with lubrication faulty, the surface of the Magnolia Metal bearing suffered no harm; it rather adapted itself more and more to the journal and became more highly polished. The bearing once in good working order ran well at 380 revolutions per minute under a pressure of 30 kg|cm² or 426 lbs.|inch² with Thin Spindle Oil and also with Paraffin Oil. With Gas Engine Oil, as lubricant, much greater pressures were admissible at 390 revolutions per minute. At 740 revolutions per minute the bearing ran well, even at 38 kg|cm² or 540 lbs.|inch², and at 1110 revolutions per minute a pressure of 26 kg|cm² or 370 lbs.|inch² could be applied. As regards the influence of pressure, speed and temperature upon the friction co-efficients, the accompanying diagrams give full information.

(Signed) Stribeck."

SPECIAL OFFER

PRACTICAL ENGINEER POCKET BOOK—700 pages, over 2000 subjects. Price 40c post paid. We import these books in large numbers from England, as an advertising medium, and give Engineers benefit of low price. They are highly spoken of. **Address Montreal Office.**

SOLD BY LEADING DEALERS EVERYWHERE OR BY

MAGNOLIA METAL CO.

OFFICE AND FACTORY:

225 St. Ambroise St. MONTREAL

The advertiser would like to know where you saw his advertisement—tell him.

Use Stephenson Bar Belt Dressing

Make 1913 a record breaking year. Turn over a new leaf and get rid of the things that have been causing needless trouble and expense. Adopt the things which will make your work easier, give better results and save money for your employer. You cannot start at a better place than with your belt dressing.

Get rid of your troublesome liquid dressing. Shake the can for the Stephenson solid stick and shake trouble at the same time.

Stephenson Bar Belt Dressing is a friend in need. It doesn't require preparation, nor do you have to use special care in applying it. The minute the belt slips you hold the Stephenson bar to the belt for a few seconds and the slipping stops. There's no waste—no slop—no smearing on of paste or pouring on of spattering liquid. And the results are better.

I'll "Stick to the Solid Stick"

Start With a Free ½ Lb. Sample

Simply send us your name and address and we'll send you a present in the shape of a free half-pound sample of Stephenson Bar Belt Dressing.

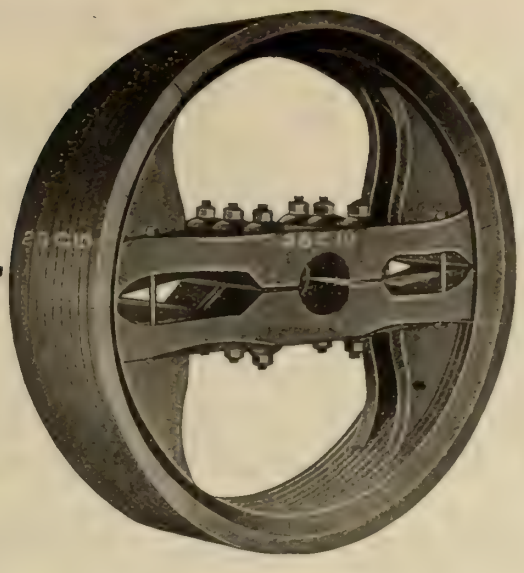
Remember—we give you this sample absolutely free of charge. Get this free half-pound of the finest belt dressing made and test it. Here's your chance to try somesomething really good at no expense.

None Genuine Without Trade-Mark

Stephenson Manufacturing Company

Est. 1888 Albany, N.Y. Inc. 1897

The advertiser would like to know where you saw his advertisement—tell him.



For Power Transmission

Use Fairbanks

Wood Split Pulleys

These Pulleys are the result of years of experience in the manufacture of Wood Pulleys. They embody many excellent features and are conceded to be in every mechanical detail, the most perfect Wood Pulley made.

The arms are made of birch in varying numbers of sections according to the width of the pulley, and are clamped to the shaft by through bolts.

A special feature of construction which makes these pulleys the peer of all others and overcomes the inherent objection to Wood Pulleys, i.e., the separating of the rim from the arms, is the web. This web is mortised into the arms and rim, securely holding the whole pulley together.

The Rims and also the Webs are made of thoroughly seasoned bass wood, as it will transmit 25 to 60 per cent. more power than any other. The Rim is built up in segments or "lags" about 6 inches long. Every layer breaks joints with the preceding layer and each segment is nailed to the others by triple coated nails. These nails are triple coated to prevent them from pulling out and as a protection against dampness, oil, etc.

Each pulley is covered with several coats of special water-proof varnish, which forms an excellent surface for the belt.

These pulleys are bored to a standard and have a complete system of interchangeable Wood Bushings, one set of bushings furnished with each pulley.

ASK FOR CATALOG No. 17

The CANADIAN FAIRBANKS-MORSE COMPANY, LIMITED

SCALES, VALVES, GAS ENGINES, PUMPS, RAILWAY AND CONTRACTORS' SUPPLIES, ETC.

Montreal, St. John, Ottawa, Toronto, Winnipeg, Saskatoon, Calgary, Vancouver, Victoria.

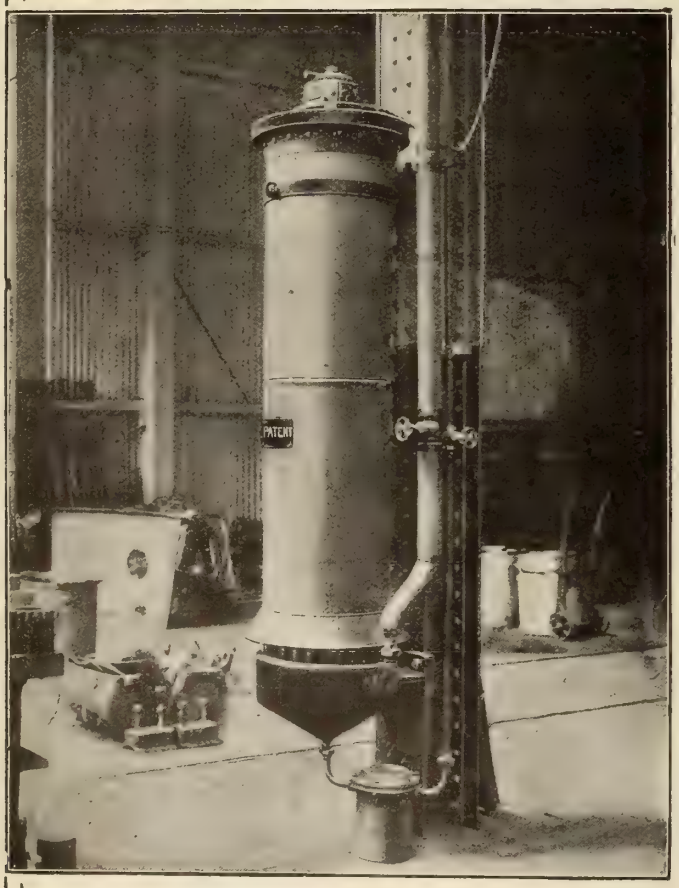
Ventilating a Valuable Fact

A Subject of Vital Importance to Your Business

It is a well established fact that a man working in a properly heated and ventilated shop can accomplish far more than the same man working in a poorly heated and ventilated shop. He can do more, and do it better, and stands a bigger chance of doing it day in and day out.

THE STANLOCK SYSTEM of Heating and Ventilating

Inexpensive at the start and completely satisfactory in use. Adopted by many leading engineers and big manufacturers in this country and Europe.



The System

This system consists of units as shown below. They are made of steel tubes screwed into circular cast iron bases and through these tubes steam passes. Enclosing these tubes is a sheet metal cylindrical casting with a motor at the top. The air is forced downwards, thus keeping the floor warm. A special pipe can be fitted, passing through the roof or through the side wall, thus giving a supply of fresh air. Dampers are provided so that the inside air can be circulated or outside air can be taken in and heated. Can be installed in old or new buildings.

Its Advantages

1. No overhead air ducts are required.
2. No underground masonry ducts are required.
3. No obstruction to light due to overhead air ducts.
4. No heat losses due to radiation from air ducts.
5. Minimum of power absorbed.
6. Units hung on walls. No floor space needed.
7. Various units operated independently and can be turned on or off like radiators. Some supply fresh heated air and others merely circulate and heat.
8. A unit using 60 lb. steam pressure heats 3,600 sq. ft. of floor space.
9. The first cost of apparatus is very low.
10. Units may be added at any time in case of extensions, and in case of boiler shops, units may be removed entirely during the summer months, if desirable.

IT WILL PAY YOU TO ASK US FOR COMPLETE INFORMATION AND AN ESTIMATE ON YOUR REQUIREMENTS. DICTATE A LETTER TO-DAY

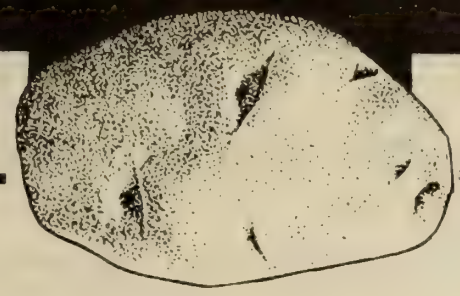
THE GARTH COMPANY

Sole Canadian Agents

26-32 Craig Street, Montreal

The advertiser would like to know where you saw his advertisement—tell him.

Potato Scale
Boiler Cleanser



Will Remove Every Particle of old Scale from Your Boilers, and if a Small Quantity is Used Continually no new Scale can Form.

It is absolutely guaranteed not to injure boiler tubes, shell or connections, and will prevent your boiler from foaming.
Let us demonstrate its worth. Send us a trial order. If not exactly as we claim, send any unused quantity back to us at our expense and we will cancel the charge for the entire amount.

TAKE ADVANTAGE OF THIS TRIAL OFFER NOW.

Send along a sample gallon of feed water for analysis and we will prepare a compound especially to suit the condition of your feed water.

Our Numidian Cylinder, Velox Engine and Sliptivity Machine

OILS

ensure the smoothest running machinery. They form a triple combination, that is, we believe, far from being equalled.

If you are not using them now, **investigate.** Get acquainted with us. Write us about them. **Ask us to send you a sample and quote you prices. Remember** when you buy these oils, you get **real quality and full measure at a reasonable price.** Our Oils win all Tests.

C. C. SNOWDON

Refinery Marketer, Importer and Manufacturer of

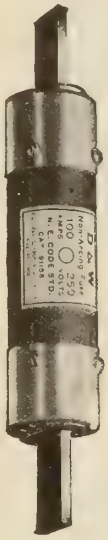
Pennsylvania Lubricating and Refined Oils, Gasoline, Potato Scale Powder, Liquid Soap, Disinfectants, Polish, Waste, Oil Tanks, Etc.

11th STREET EAST, CALGARY, ALBERTA

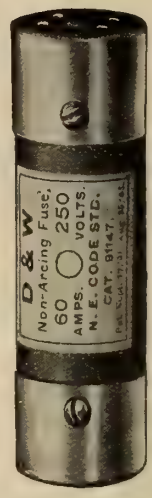
P. O. Box 1384

You Are Skating on Thin Ice

When "protecting" your electrical apparatus with enclosed fuses of inferior quality



Use "D & W" Fuses and Take No Chances



They Are Sure To Be "Right"

Scientifically Made Accurate Strongly Built

THE Northern Electric AND MANUFACTURING CO. LIMITED

Manufacturer of Telephone and Fire Alarm Apparatus, and Distributor of Electrical Supplies for every possible need.

Montreal Halifax Toronto Winnipeg Regina Calgary Edmonton Vancouver

ADANAC RED CORE RUBBER COVERED WIRES AND CABLES

Are made according to the specifications of the National Board of Fire Underwriters. The conductors are drawn from copper of the highest conductivity and are covered with two thicknesses of thoroughly vulcanized rubber compound of high quality. The wires are braided over insulation and the smooth high finish they receive makes them specially desirable for conduit work.

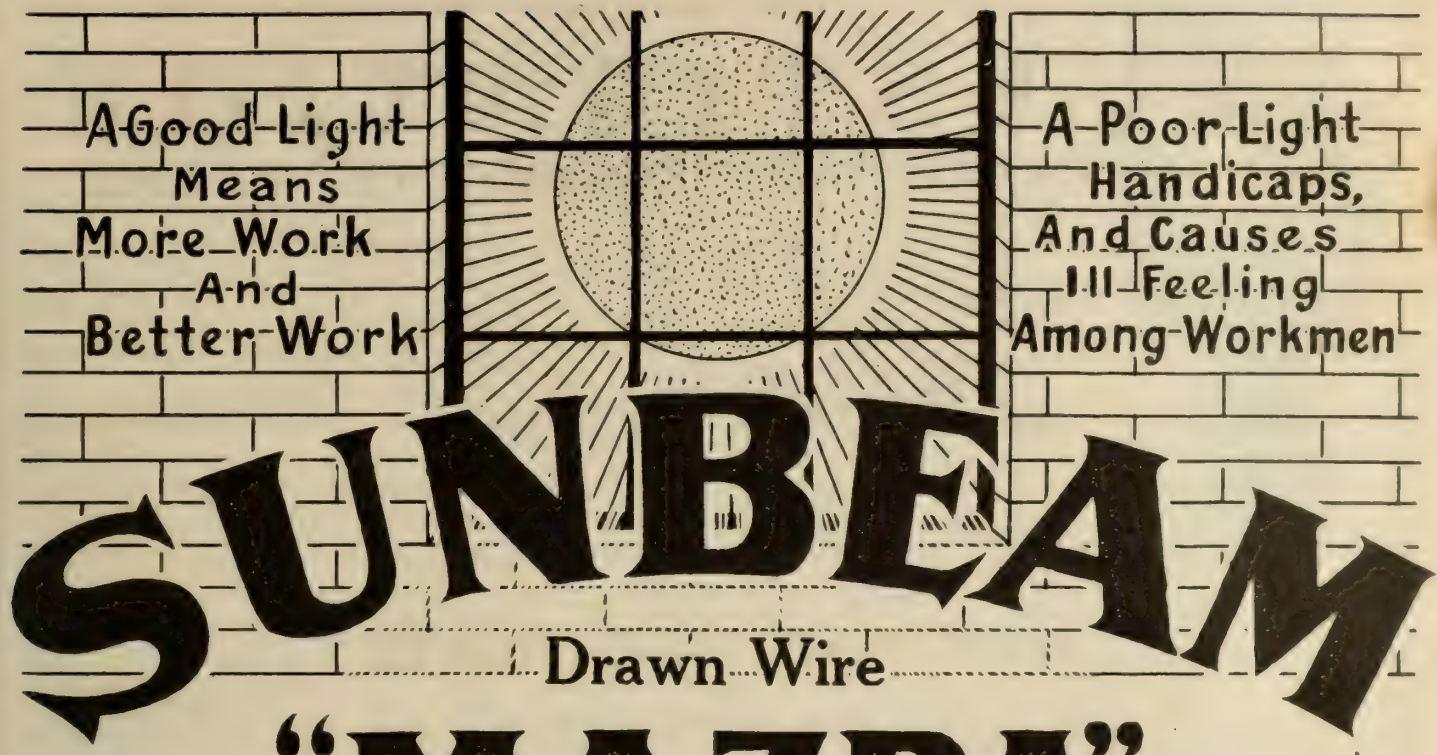
IMPERIAL WIRE AND CABLE COMPANY

Limited

MONTREAL

THE Northern Electric AND MANUFACTURING CO. LIMITED Sales Agents

TORONTO REGINA WINNIPEG CALGARY EDMONTON VANCOUVER



"MAZDA" LAMP

Will Produce BETTER RESULTS and Consume Less Current than Others

Chemically pure Tungsten metal actually drawn in the form of wire composes the filament of this highly efficient lamp.

They give a light that every factory or mill should have — a light that means larger output with greater accuracy and the good will of employees.

The Label is the Guarantee of QUALITY and SERVICE,

If your jobber cannot supply you, write us.

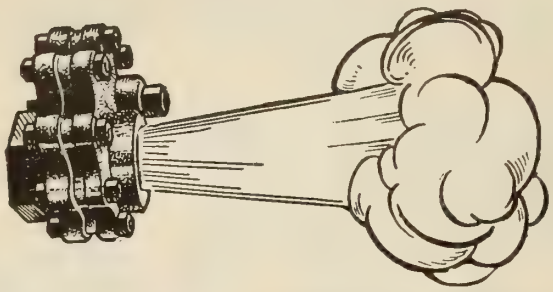
The Canadian Sunbeam Lamp Co. Ltd.

Main Office and Factory:
Dufferin and Liberty Streets Toronto

Northwestern Office and Warehouse:
173 McDermott Avenue Winnipeg

INVESTIGATION
OF "EVERLASTING" BLOW-OFF VALVES
Will Prove Many Facts

IT NEVER LEAKS!



MADE IN MANY TYPES FOR

Stationary
Locomotive
Marine
Ammonia
Gas and Air

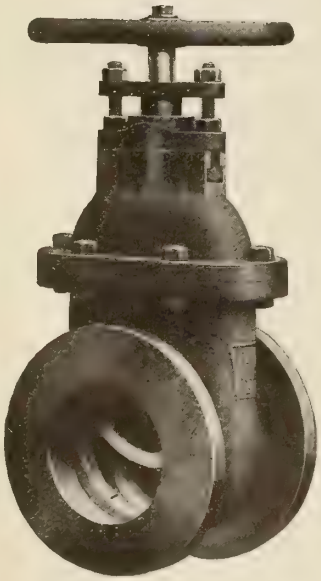
WHY NOT INVESTIGATE?

SOLD AND MANUFACTURED UNDER CANADIAN PATENTS BY

Engineering Specialties Company, 1080 King St., West, TORONTO

AGENTS

MONTREAL, QUE. H. L. Peiler & Co.
ST. JOHN, N.B. The A. R. Williams Mach. Co.
WINNIPEG, MAN. The A. R. Williams Mach. Co.
CALGARY, ALTA. P. D. McLaren Limited
VANCOUVER, B.C. Taylor-Forbes Company, Limited



6" Flanged End
Kerr Gate Valve

When next you order an Iron Body Gate Valve, Specify

Kerr's New Pattern

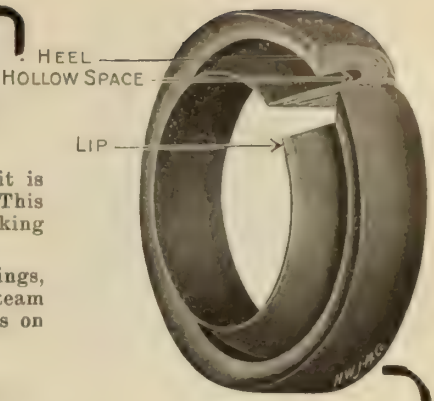
LIKE THIS ILLUSTRATION

We want you to see and try what we know to be the strongest and best made Valve on the market for Standard Pressure. Every Valve tested 300 pounds Hydraulic Pressure.

THE KERR ENGINE CO., Limited

WALKERVILLE, ONTARIO

How to Reduce Piston Rod Friction Over 75%



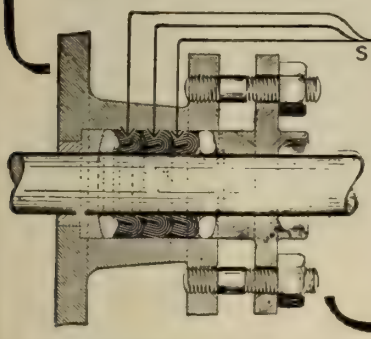
Every engineer knows that when soft packings are used in the stuffing box it is necessary to have them press tightly against the rod in order to prevent leakage. This means friction on the rod at all times on both strokes—a constant wear on both the packing and the rod, and a constant load to overcome.

This rod friction can be reduced more than 75 per cent. by using J-M Sea Rings, because they exert pressure on the rod only when there is pressure on them by the steam or contents of the cylinder on the return stroke. And the pressure of J-M Sea Rings on the rod is always in exact proportion to the pressure on them.

J-M SEA RINGS

therefore eliminate unnecessary wear on themselves and on the rod, and effect a direct saving in fuel ordinarily required to overcome rod friction.

They are made of a laminated wedge of Asbestos, flax, or duck, turned over on itself. Withstand highest pressures and are the ideal packing for superheated or saturated steam, high pressure hydraulics, marine engines, steam hammers, hot or cold water pumps, air compressors, etc.



Our "Blue Book" thoroughly explains and illustrates all the valuable features of J-M Sea Rings. Tear out this paragraph, write your name and address on the margin, and mail to our nearest Branch, and we'll send you a copy.

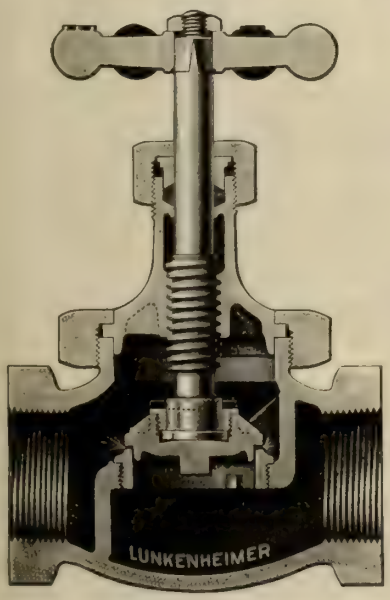
THE CANADIAN H. W. JOHNS-MANVILLE CO., LIMITED

Manufacturers of Asbestos and Magnesia Products — TRADE ASBESTOS MARK — Asbestos Roofings, Packings, Electrical Supplies, Etc.

TORONTO MONTREAL WINNIPEG VANCOUVER

1666

LUNKENHEIMER "RENEWO" VALVES



When you buy a **Lunkenheimer "Renewo" Valve** you get a valve as perfect as modern science and ingenuity can produce, coupled with the careful selection of the best of only new material and the employment of men skilled in the manufacture of engineering appliances.

The "**Renewo**" is a valve of **exceptional durability**, made so not only because of the **high grade material used**, but also owing to the **scientific construction of the seat and disc**, which parts are subjected to the greatest wear. Their peculiar construction **greatly minimizes the wear on the seating** faces (caused by the velocity of steam flowing through the valve) and **positively prevents any scale or dirt lodging on these faces** when the disc is about to seat, thereby preventing injury to them.

To further insure durability, **both the seat and disc are made of a most durable nickel alloy**, a material best suited for the hard service to which these parts are subjected.

A slight wear on the seating faces can be easily remedied by regrinding—a process that can be quickly accomplished without detaching the valve, and ore that will make the valve as tight and as serviceable as when first installed.

The last but most important feature of **Lunkenheimer "Renewo" Valves**, as regards durability, is the fact that **all parts subjected to wear are renewable**, and this particularly includes the **seat and disc**, and when renewing any of these parts, it is not necessary to break the pipe connections.

The body and trimmings, with the exception of the seat and disc, are made of the highest grade of bronze composition, containing a large percentage of copper and tin, and to insure a uniform mixture, **only new material is used.**

Lunkenheimer "Renewo" Valves are made in sizes ranging from ¼ to 3 inches, inclusive, and in two weights: Medium, for working pressures up to 200 pounds, and Extra Heavy, for 300 pounds.

"MOST supply houses sell them—yours CAN—if they DONT or WONT—tell **US.**"

Write for catalogue.

THE LUNKENHEIMER COMPANY

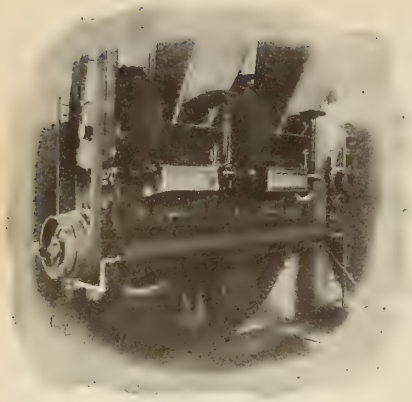
1-43

Largest Manufacturers of High-Grade Engineering Specialties in the World.

General Offices and Works: CINCINNATI, OHIO, U. S. A.

NEW YORK, 64-68 Fulton St. — CHICAGO, 186 N. Dearborn St. — BOSTON, 138 High St. — LONDON, S.E., 35 Great Dover St.

The advertiser would like to know where you saw his advertisement—tell him.



The Stoker for Pulp and Paper Mills where cheap steam without smoke or grits is essential.

Bennis New Link Chain Grate Stokers
Bennis High Temperature Cooking Stokers
AND
Patent Self-cleaning Compressed Air Furnaces
FOR
Water Tube and Horizontal Return Tubular Boilers

Bennis Machines are **saving** millions of dollars a year.
Bennis Machines are supplying over 3¼ millions of Horse Power.

Bennis Machines are hourly demonstrating in actual practice what CHEAP STEAM really means. They show what can be done with poor-grade, low-price fuels when efficiently burnt. They are designed and constructed to save boiler life; to keep down the coal bill; to abolish smoke, and to ensure maximum results from each pound of coal.

Bennis Stokers are constructed with the greatest care and fitted to meet individual conditions. They are SPECIALLY DESIGNED for the various types of boilers.

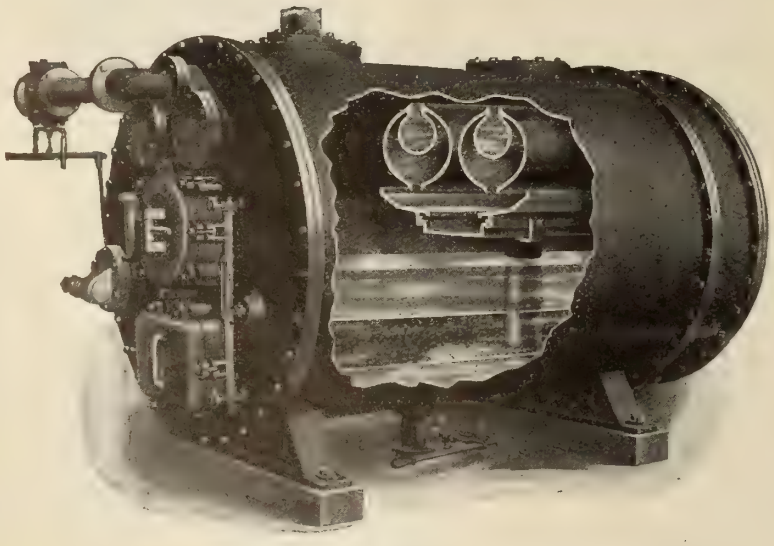
The coal is automatically carried from the store to the furnace when the Bennis Machine Stokers are fed by means of Bennis elevators and conveyors. Bennis Coal and Ash-handling Plant has acknowledged advantages over other types. One marked advantage is the small amount of power required to operate it effectually.

Write for "**Common Sense Machine Stoking**" pamphlets and full particulars to:

G. H. TOD, 213 Manning Chambers Queen Street West **TORONTO**

A central station in the Midlands, England, where Bennis plant has established record economies.

Are you going to say "I don't know" when someone asks you—an engineer—a question about the



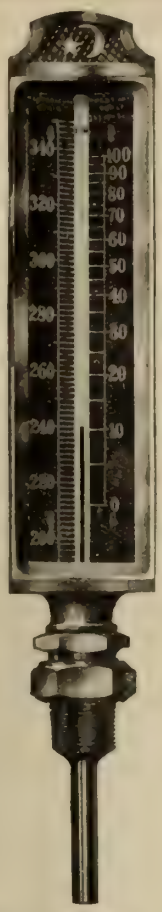
National
Direct Contact Feed Water
Heater

Look up this new heater at once—send for the catalog.
It's an open heater, different from the others.
Contact pipes warm the water just before it comes in contact with the exhaust steam.
It has upward-filtration which reduces the cleaning and renewals of filter bed material.
In case of accident the material will not be carried over to the pump.
Plenty of time and room for the solids to settle. Lots more information in the catalog.

The National Pipe Bending Co., 91 Lloyd Street, NEW HAVEN, CONN.

46-10

The advertiser would like to know where you saw his advertisement—tell him.



Where Only the Best is Installed

It is false economy indeed when buying instruments not to obtain the best. A mariner certainly would not use a "doubtful" compass, then why should you use "doubtful" instruments?

Our line of mechanical instruments is a "Stronghold of Quality" and "Precision" is the password. Where only the best is installed S & B "Quality" instruments are sure to be dominant. Among our line of

"Crescent" Thermometers

will be found an instrument for every conceivable purpose. The "Crescent" Thermometer has a well-earned reputation for its perfect workmanship, lasting accuracy, and handsome appearance. It is a "Quality" instrument through and through and what is more surprising it is not more expensive than others.

You should have a copy of our handsome catalogue fully illustrating and describing more than seventy styles and types of "Crescent" Thermometers. It is well worth having and it's yours for the asking. Write *now* for copy of catalogue W-27.

THE SCHAEFFER & BUDENBERG MFG. CO.

BROOKLYN, N. Y.

Chicago **Pittsburgh** **Washington**

"SIMS" TUBULAR FEED WATER HEATERS

Will Save Your Fuel And Prolong The Life Of Your Boiler

Saves fuel by utlizing the heat units in the exhaust steam to raise the temperature of the feed water, at the rate of one per cent. of fuel to every eleven degrees increase in temperature.

The life of the boiler is prolonged and repairs reduced by obviating strains from expansion and contraction, bound to occur when feeding cold water.

The "Sims" is noted for its simplicity, its durability, and its splendid service-giving qualities.

We make "Sims" Feed Water Heaters in all sizes; to and including 700 H.P. with cast iron sheets, larger sizes with steel shells.

The Heating surface is provided in seamless cold drawn brass tubes, rolled into a fixed head at one end, and a floating head at the other, thus providing against strain due to contraction and expansion.

The Tubes are so grouped as to insure positive circulation in several passes through the heater from inlet to out.

Get full particulars at once on this money saver.

THE SIMS COMPANY, - - Erie, Pa.

CANADIAN REPRESENTATIVES:

H. L. Peiler & Co., 380 St. James Street, Montreal. Que., and 79 Adelaide Street West, Toronto, Ont.

The advertiser would like to know where you saw his advertisement—tell him.

THE VULCAN IMPS

I SAVE LABOR
SO DO I
I CLEAN TUBES EVERY FEW HOURS
I CLEAN TUBES 100%
I INCREASE BOILER CAPACITY
I LIKE TO PLAY WITH MY COMPETITORS
I BLOW WITH THE DRAFT
I SAVE HOSE

"And We All Save Coal"

Wherever the **VULCAN SOOT CLEANER IMPS** are allowed to work they raise the Devil—the Soot Devil. They juggle the heat units and make two units grow where one unit grew before. They make slow steaming boilers "pop" for the first time in years. They give many a weary engineer and fireman a chance to rest. The IMPS are always on the job, "they work while you sleep." They cut out lost time, trouble and repairs. They are good for the operating man and mighty good for the boiler owner. Don't let Soot, the expense maker, worry you longer. Fill out the coupon, mail it now, and we'll send you our Free Booklet, "Economical Steam Production," which shows how the Vulcan removes Soot, and saves from 5 to 15% in fuel.

Mail the Coupon

Vulcan Tube Cleaning Systems,
LIMITED

42 Craig St. West **MONTREAL**

SIGN, TEAR OUT AND MAIL

P.H. 10-12. Date.....

VULCAN TUBE CLEANING SYSTEMS, LIMITED, Montreal.

Please send me, without charge, your book—ECONOMICAL STEAM PRODUCTION, and your proposition.

(It is important that following information be given in full.)
WATER TUBE BOILERS. Number.....Type.....
Pressure .....Horsepower .....No. Tubes H
(except on Stirling boiler .....Any Superheaters .....Width of alley space at side .....
TUBULAR BOILERS. Number.....Horizontal or Vertical .....
Name .....
Address .....

MORE POWER TO YOU *SIR!*

¶ You who bear the brunt of getting a capacity output and showing a satisfactory profit.

¶ More power to you, ***sir!*** We respect your energy, your nerve, your aggressive effort, and we're anxious to help lighten the burden.

¶ Here's what ***we*** can do—

¶ We can show you how to get MORE POWER out of your present equipment—how to reduce fuel expense—how to avoid boiler failures and repair bills—how to avoid shut-downs and interruptions of output.

¶ That ***would*** help, wouldn't it? Then listen—

Dearborn Treatment

¶ Our scientific method of ***analyzing*** and ***treating*** boiler feed water positively prevents corrosion and the formation of scale in the boiler tubes or on the sheets.

¶ Scale ***insulates***, thereby increasing fuel consumption and decreasing power production. By keeping the tubes and sheets absolutely free from scale, we give you MORE POWER and LOWER FUEL COST.

¶ Dearborn Treatment, prescribed after scientific analysis, stops priming, foaming, pitting, bagging, and all feed water troubles, which are ***more serious*** and costly in their consequences than most manufacturers realize.

¶ Send us a gallon jug of your boiler feed water for analysis and report.

Dearborn Chemical Company

General Offices, Laboratories and Works **CHICAGO**

THERE MUST BE A REASON

FOR REPEAT ORDERS

For Murphy Automatic Smokeless Furnaces

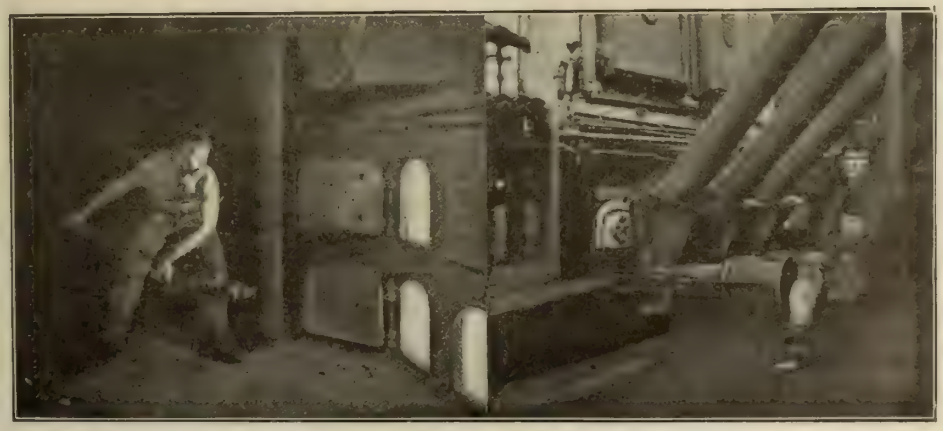
THE HARRIS ABATTOIR CO., Ltd., Toronto, Ont., has had three years' experience with Murphy Furnaces :

1st order	Aug. 1909 . . .	1 furnace, 250 H.P.
2nd "	Oct. 1909	2 furnaces, 500 H.P.
3rd "	Dec. 1912 . . .	3 furnaces, 900 H.P.

This last contract is for equipment for their new abattoir.

Write to-day for Catalogue

MURPHY IRON WORKS, DETROIT, MICH. BUFFALO, N. Y.



The "hand-fired" method — The Jones Stoker method

The Jones STOKER

has other advantages besides **saving labour** in the boiler-room!

THE JONES STOKER abates smoke by **PREVENTING** its formation!

THE JONES STOKER is without grates, consequently does not lose the fine coal through grate bars—nothing but incombustible clinker leaves the fire!

THE JONES STOKER increases the boiler horse-power developed, by its unlimited capacity to feed coal and simultaneously introduce the extra air required in the proper proportion for the combustion of same!

THE JONES STOKER maintains a constant steam pressure because of the automatic control of the **air supply** and the **coal supply** by the steam pressure itself!

THE JONES STOKER immediately responds to fluctuating loads and sudden demands for steam!

THE JONES STOKER preserves the heating surfaces of the boiler free from soot deposits due to perfect combustion!

THE JONES STOKER cost for maintenance is low, because there are no moving parts in contact with the fire!

THE JONES STOKER in a small plant makes smoke abatement just as effectual, economy just as much a consideration relatively as in a large one.

Jones Underfeed Stoker Co., Limited National Trust Bldg. TORONTO

Marsh Steam Pump

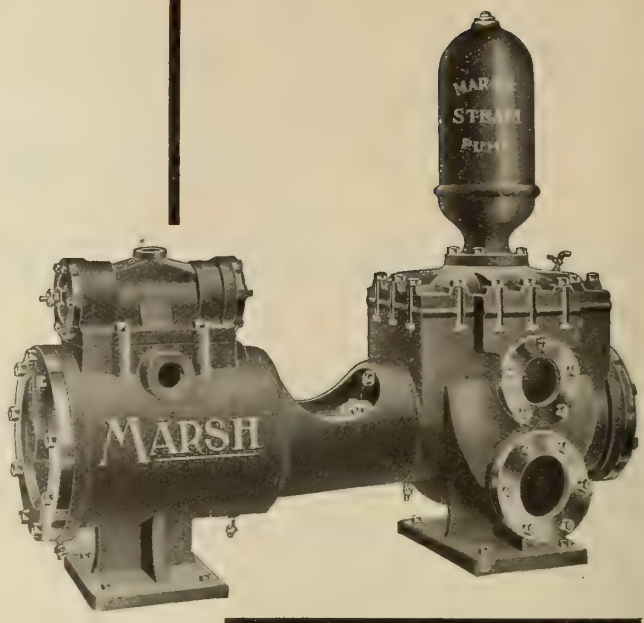
The Pump with the Self-governing Steam Valve

Note the extreme simplicity in construction and the absence of outside valve motion. There is practically nothing to get out of order. Nearly all the wearing parts are made of phosphor bronze instead of common brass, including piston rod, water cylinder lining and valve seats.

The steam valve is self-governing and admits only just enough steam to do the required work. The pump cannot short-stroke, race or pound under the most severe conditions.

115,000 in successful operation.

Ask for Catalog No. 18



American Steam Pump Company
BATTLE CREEK - - - MICH.

CANADIAN AGENTS

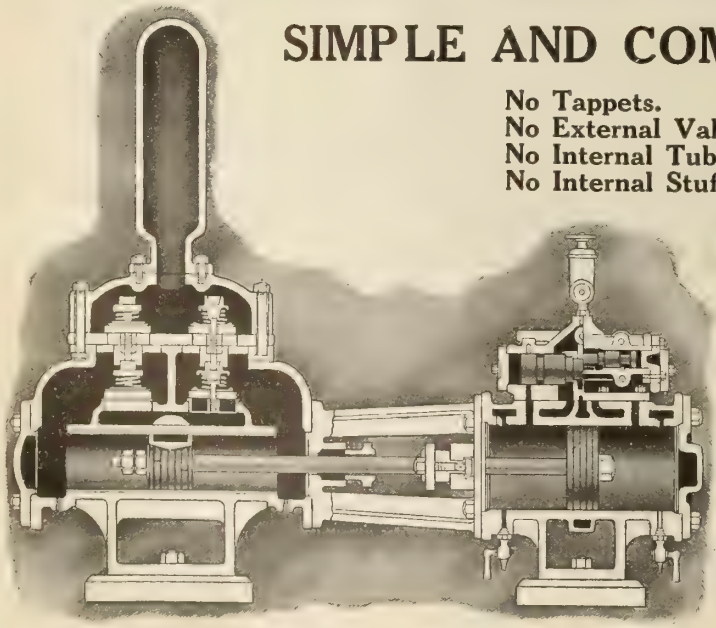
A. R. Williams Machinery Co., Toronto
Williams & Wilson, Montreal
London Engines Supplies Co., London, Ont.
Stuart Machinery Co., Winnipeg
Hallman Machinery Co , Vancouver, B. C.
Mechanics' Supply Co., Quebec, Que.
Gorman, Clancey & Grindley, Limited
Edmonton & Calgary

"BAWDEN" STEAM PUMPS

MANUFACTURED UNDER ATTWOOD'S PATENTS

SIMPLE AND COMPOUND, For all Purposes

No Tappets.
No External Valve Gear, Levers or Springs.
No Internal Tubes.
No Internal Stuffing Glands.



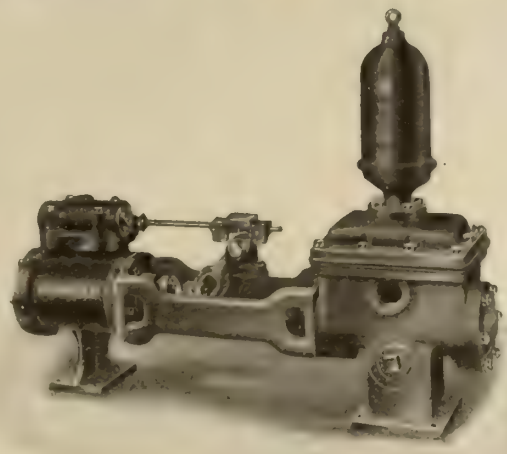
"Bawden" Pumps are governed by piston valves which are controlled by the action of live steam only.
—Simplicity throughout.
—Guaranteed to make full stroke under constant or varying loads.
—Valves, latest improved steam balanced type.
—Greatest economy of steam consumption.
The Bawden Pump provides the simplest, most economical and reliable means for feeding high or low pressure boilers.
Flexibility of speed obtained without any mechanical adjustment.
Automatic cushioning of piston and valves ensures greatest safety in any emergency.

THE BAWDEN MACHINE CO., Ltd., Toronto, Can.

BURNHAM STEAM PUMP

Of the thousands of steam pumps installed every year, a large percentage of them bear the name of "Burnham," the **Steam Pump** endorsed by leading Architects, Consulting Engineers and Heating Contractors as the best, simplest and most economical pump on the market.

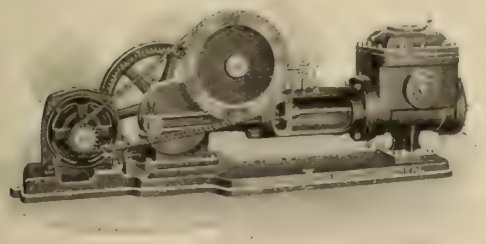
If you want a pump for handling hot water, use the "Burnham."



Burnham Boiler Feed Pump.

Thousands of Burnham pumps are in operation in connection with **Vacuum Heating Systems**; they are specially adapted for this service. Standard Burnham Boiler Feed Pumps and Burnham Vacuum Pumps are kept in stock and can be shipped promptly.

Ask for Catalogue "P."

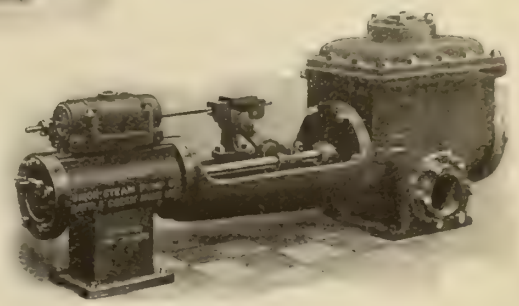


Union Electrically Driven Vacuum Pump.

Darling Brothers,
LIMITED

15 Ottawa St., Montreal.

Toronto, Winnipeg and St. John.



Burnham Vacuum Pump.

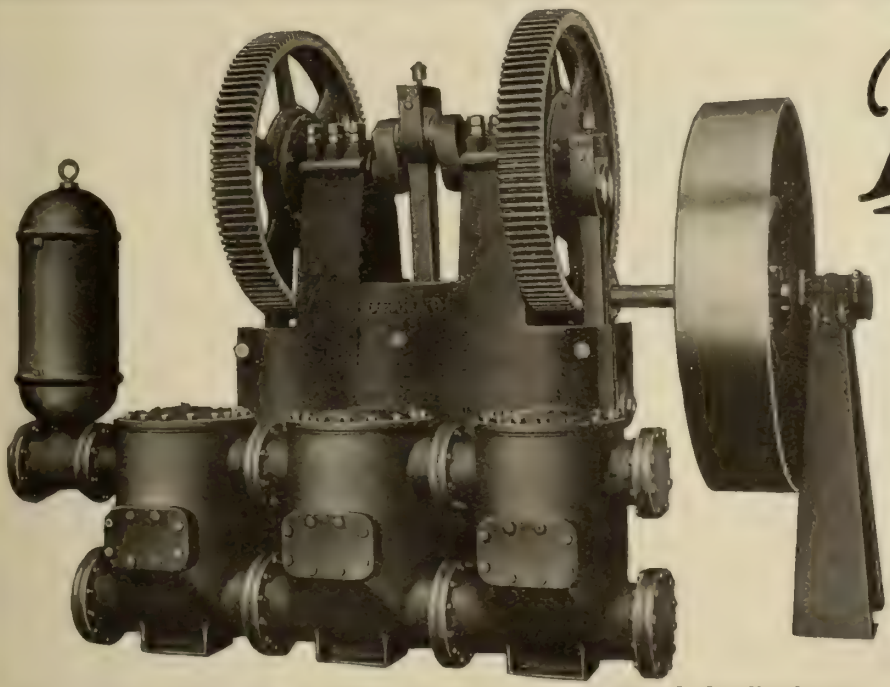


Fig. 50. Single-Acting Triplex Power Pump for boiler feeding, hydraulic elevator service, water works and general water supply. Made in sizes from 2 x 2 to 13 x 14. Suitable for pressures of 140 to 160 lbs. Capacities from 340 gallons per hour to 58,000 gallons per hour.

DEMING POWER PUMPS

are made for light or heavy duty in many sizes, either single or double acting.

They cut steam costs; are almost automatic; have a low maintenance expense; may be operated by any power; deliver an even and uniform stream without pulsations.

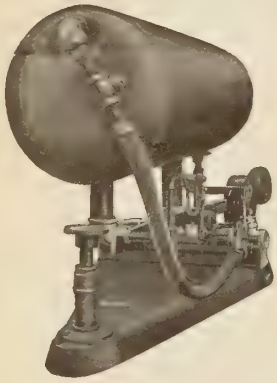
To any factory official who is interested, we will gladly send one of our "H" Catalogues of power pumps, which has been "reviewed" as the most complete and most beautiful power pump catalogue ever printed.

The Deming Company, Salem, Ohio

Manufacturers of Hand and Power Pumps for all uses

AGENCIES: Henion & Hubbell, Chicago; Darling Bros., Montreal, P.Q.; Root, Neal & Co., Buffalo, N.Y.

The advertiser would like to know where you saw his advertisement—tell him.



The Morehead Condenser Trap makes its own Vacuum

and PULLS the accumulated water and air out of your steam lines, insuring rapid circulation. Enables you to cut down your boiler pressure on direct heating systems.

Particularly adapted for use in connection with reduced pressure and Exhaust Steam Heating Systems, Dry Kilns, Dryers, Fan Stacks, Etc.

Write for Particulars and a Trial Trap.

Canadian Morehead Mfg. Co.
WOODSTOCK, ONT.

THE
CANADIAN CASUALTY
AND
BOILER INSURANCE
COMPANY

ATTENTION:

In what condition have you left your heating boiler? we would like the privilege to inspect it, and report to you what has to be done before the next heating season.

CONTINENTAL LIFE BUILDING
TORONTO

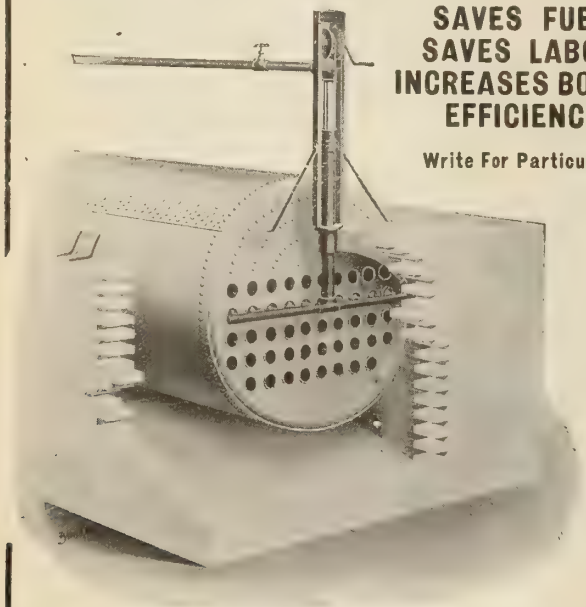
J. O. B. Latour, Chief Engineer.
John J. Durance, Manager.
Phone Main 6941

'THE HENRY' STEAM FLUE CLEANER

Will Do Its Work While Boiler Is In Actual Use.

SAVES FUEL,
SAVES LABOR,
INCREASES BOILER
EFFICIENCY

Write For Particulars



THE STEAM APPLIANCE CO.
MILWAUKEE, WISCONSIN.

Western Agent:
CANADA SALES CO.
Donalda Bldg. Winnipeg.

Eastern Agent:
ENGINEERS REPRESENTATIVE CO.
201 Board of Trade Bldg. Montreal.

HOMESTEAD
STRAIGHTWAY VALVES

ALWAYS OUTLAST
OTHER VALVES

For Pressure Up to
5000 lbs. per. Sq. In.

The reason is very evident.

Where the common Globe and Gate Valves have their vital parts—the seats—exposed to pressure and constant wear, every minute they are open, the seat of the Homestead Straightway is never exposed.

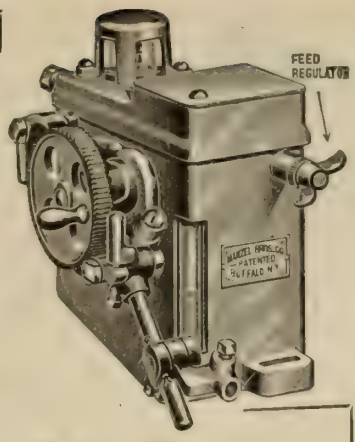
The plug is balanced and held in place by the pressure when open, and when closed it is locked in the seat by our patent wedging cam, insuring freedom from friction in the seat while the plug is turning and making the Homestead the quickest acting, the simplest, the most easily operated and the most durable valve known.

Let us send full details. Write

Homestead Valve Mfg. Co.
PITTSBURG, PA.

The advertiser would like to know where you saw his advertisement—tell him.

For Positive and Economical Lubrication, Regularity of Feed, Ease of Adjustment and General Convenience, Nothing can be found to equal the



MANZEL

AUTOMATIC FORCE AND SIGHT FEED Oil Pump

for lubricating the cylinders of steam engines and pumps.

No matter how slow the engine runs, what pressure of steam is carried; how high or low the temperature, or what grade of oil is used, the **Manzel Oil Pump** will feed the Oil into the cylinder regularly and positively all the time, and will give the cylinder better lubrication, with a **saving of 50%** over that of any hydrostatic lubricator.

Let us send it to you on a thirty day's free trial. If not found exactly as represented we will send it back at our expense.

Write us to-day.

THE TWIN CITY OIL COMPANY
General Agents for Canada
BERLIN - ONTARIO
Manzel Brothers Company, Buffalo, N. Y.

GRAPHITOL

Pat. and Trade Mark Reg'd.

The graphite cement bearing material.
Another step in the ladder of progress.
A distinct advance over babbitt metals.
The most frictionless material yet produced.
A thorough success.

Write for free illustrated pamphlet describing this material, to

British Pacific Supply Company
F. C. Winkler, Manager,
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MAKERS OF GRAPHITOL.

KEEP YOUR BOILERS FREE FROM SCALE

And Save Fuel, Time and Money by Using

WALKER'S ELECTRIC BOILER COMPOUND

If your boiler tubes are coated with old scale this compound will remove it quickly without the slightest injury to tubes or fittings.

Small quantities used regularly will keep the tubes clean and increase boiler efficiency.

Regal Valve Oil
Red Star Cylinder Oil
Monarch Cylinder Oil
Superior Engine Oil
Electric Engine Oil
Vulcan Machine Oil
Heavy Red Machine Oil
Brush Dynamo Oil
Gas Engine Oil and
all Engine Supplies.

It will pay you to get acquainted with these **High-Grade Oils.** They are not high in price but will produce results equal to the most expensive.

We want you to be convinced of their real value.

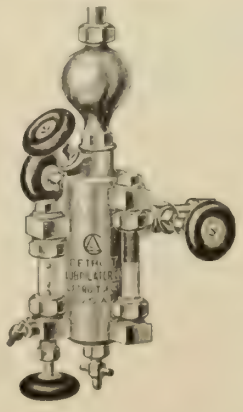
Write for samples.

The Electric Boiler Compound COMPANY, LIMITED
Guelph, - - Ontario

New Detroit Catalog

The big, new 232 page Detroit catalogue is complete in every way.

It shows a full line of lubricators for every condition met with on every kind of steam engine, steam pump, air compressor, ammonia cylinder. It fully illustrates and describes Detroit locomotive lubricators and specialties, mechanical force feed oilers for gas engines, hand pumps, glass oilers, brass oilers, grease cups, ground key work, water gauges, fusible plugs and other boiler trimmings, valves, and a multitude of other devices.



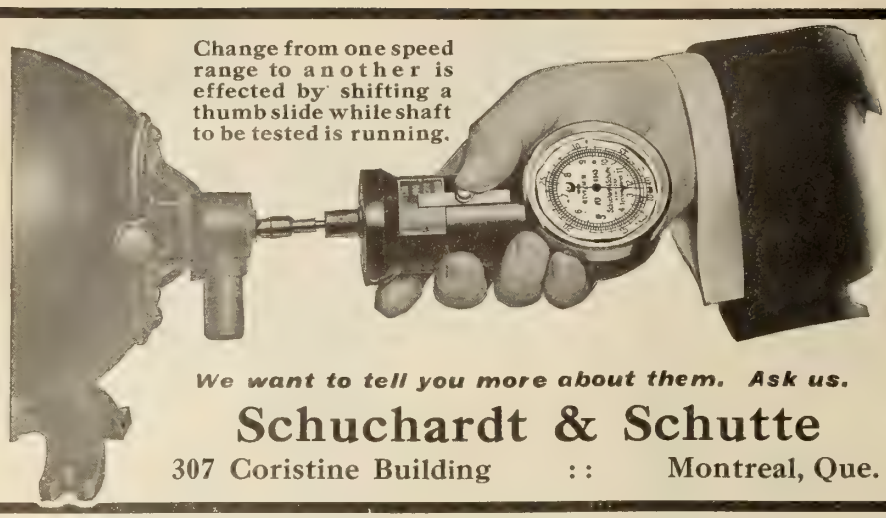
It shows repair parts for all Detroit Lubricators, gives complete instructions for their installation, care and operation, and contains valuable information on the general subject of lubrication.

This book will help you with your work

If you would like to know more about lubricators and lubrication, this book should contain the information you want. If it doesn't our Engineering Service Department will be glad to help you.

Write for catalogue G-58.

CANADIAN DETROIT LUBRICATOR COMPANY, LTD.
Walkerville, Ont.



Change from one speed range to another is effected by shifting a thumb slide while shaft to be tested is running.

Do You Guess, or Do You Know

the capacity of your machines?

S & S Tachometers

tell you instantaneously and indicate accurately. No calculating or timing with a watch.

We want to tell you more about them. Ask us.

Schuchardt & Schutte

307 Coristine Building :: Montreal, Que.

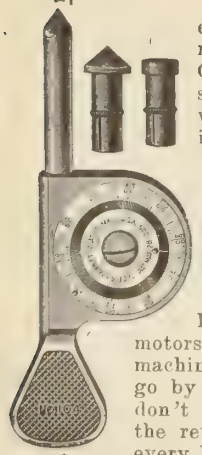
In mechanical strength, wearing quality, fineness of texture and lubricating quality every Le Carbone Brush in a million is absolutely uniform.

This means that a type of Le Carbone Brush once installed to meet your conditions will always meet them on subsequent shipments. The quality of Le Carbone Brushes never varies.

Rougier Freres, Inc.

63 NOTRE DAME EAST, MONTREAL

Do You Know Your Engine Speed ?



Are you getting best results from your engine, or motors, or from any of the machinery for which you are responsible? Or, on the other hand, are you ever-speeding some of these machines, and wearing them out too soon, without knowing it?

The accurate, simple way is to use a

Starrett Speed Indicator

It will indicate highest speed without heating. You can use it on engines, motors, shafting, grinders, or any kind of machinery, and you'll know you're right if you go by what it says. If the light is poor you don't need to watch the dial, for the knob on the revolving disc passes under the thumb at every hundred revolutions.

Rubber tips for pointed or centered shafts prevent slipping. Costs only a dollar. Your hardware dealer will be glad to show you one.

Send for catalogue No. 19CD

THE L. S. STARRETT CO.

ATHOL, MASS. 42-12

Notice to Stationary Engineers

Everyone operating a Stationary Steam Plant of 50 h.p. or over, in the Province of Ontario, must hold a Certificate from this Board. Anyone operating such a plant without a Certificate is liable to the penalties set forth in the Stationary Engineers' Act

HON. J. S. DUFF, Minister of Agriculture.

W. C. McGHIE, Chairman of Board, Parliament Buildings, Toronto

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EVERYTHING FOR

Engineers and Draughtsmen

Faber's No. 368, Slide Rule, specially graduated for Electrical Computations.

ARTISTS AND DRAUGHTSMENS MATERIALS — THE ART METROPOLE — 241 YONGE STREET TORONTO

WRITE FOR CATALOGUE.

THE ART METROPOLE

241 YONGE STREET, TORONTO

Canadian Association OF Stationary Engineers

To all whom it may concern:

All those operating steam or electrical plants know that to advance in their special profession something new must be added constantly to keep up with the rapid developments in all the branches of the engineering profession. To you I offer the undisputed facilities and benefits to be derived by being a member of the C.A.S.E. This year has seen greater developments in our executive, owing to the aforesaid profession advancing so rapidly.

It is the wish of the present membership that all operating engineers should become members, so that we may hold our profession in the front ranks of scientific industry.

You will readily see the great advantages that would accrue from such a source.

If not a member
Why not a member?

Act at once and write for further information concerning membership to

A. KASTELLA,
Executive Secretary,
Stratford, Ont.

J. V. Jamison, President. **T. B. South,** Vice-President. **J. V. Jamison, Jr.,** Treasurer.

This "Ad" is addressed to users of

Refrigerator Doors, Windows and Ice Chutes
in Canada

for Cold Storage, Meat, Fish, Dairy, Poultry, Fruit and Vegetable products.

We guarantee our Doors not to sag or stick in the frames.

Our Hardware weighs 60 lbs. to set.

We manufacture or sell nothing else.

Our entire time and forces are directed to this line.

We supply

Linde British Refrigeration Co.
Linde Canadian Refrigeration Co. of Canada.
Armour & Co., Chicago, Ill., U.S.
Swift & Co., Chicago, Ill., U.S.

with all they use. Our latest orders are to Swift & Co., for Toronto, Can., 30 Doors; Canadian Fish and Cold Storage Co., Prince Rupert, B.C., 110 Doors.

Send for Catalogue

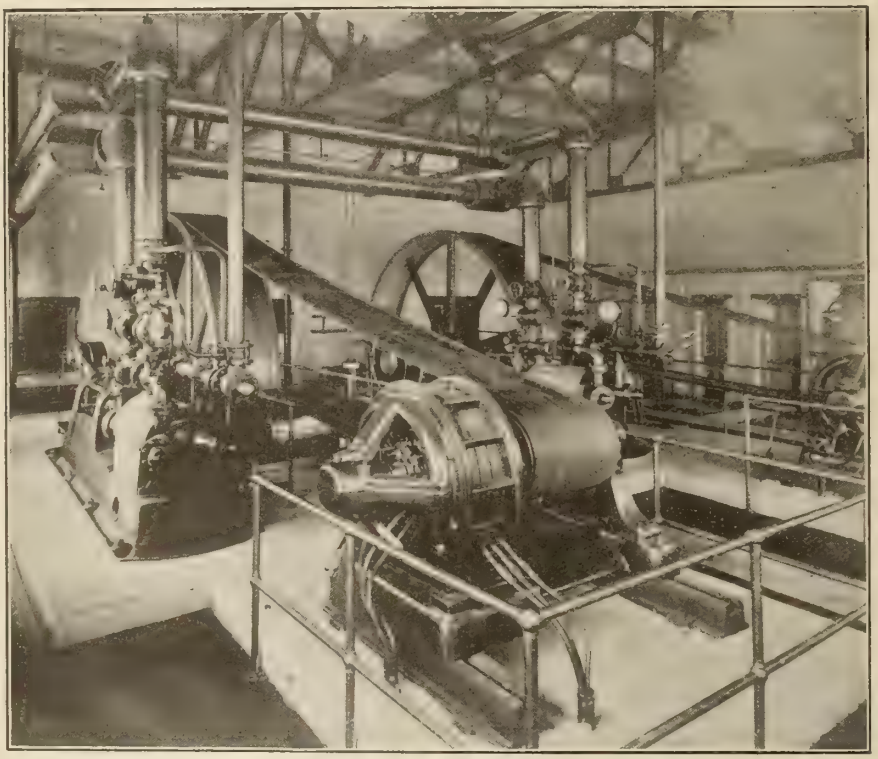
Jones Cold Store Door Co.
HAGERSTOWN, MARYLAND, U.S.A.

"THE LINDE"

REFRIGERATING and ICE-MAKING MACHINERY

CORK INSULATION

Over 8,000 Machines in use. Established and Manufacturing in Canada for 16 years.



Two 100-ton "Linde" Belt Driven, Double Acting, Horizontal Ammonia Compressors Manufactured and Installed by us in Canada.

Recent Orders:—

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C. P. R. ALGONQUIN HOTEL, St. Andrews, N.B.

AND MANY OTHERS.

The Linde Canadian Refrigeration Co., Limited

37 ST. PETER STREET, MONTREAL.

BRANCH OFFICES—Toronto, Imperial Building, Adelaide St.; Winnipeg, 909½ Main Street; Vancouver, Anderson & Miskin, Imperial Block, Seymour and Pender Streets; Edmonton, Walker & Barnes, 562 Second Street; Calgary, General Supplies Limited, 1233 2nd Street East.

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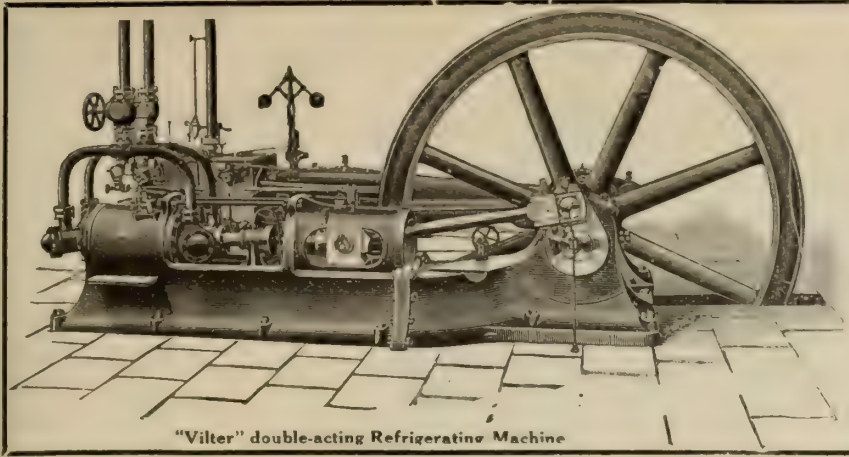


"Vilter" double-acting Refrigerating Machine

Established 1867

The VILTER MFG. CO.

242 Becher St. Milwaukee, Wis.

BUILDERS OF HIGH-GRADE

CORLISS ENGINES
ICE AND REFRIGERATING MACHINERY

any size and for any purpose, complete line Ammonia Fittings, Condensers, Brine Coolers, etc.

Write for Catalogue and full Particulars

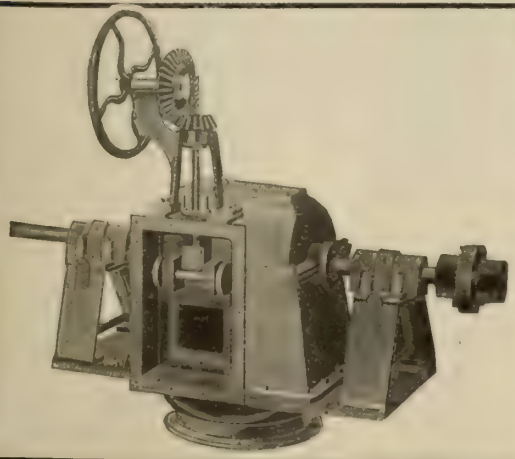
The
LINDE BRITISH
Refrigeration Co. Limited

¶ Numerous fully authenticated laboratory tests organized from time to time in America and Europe, have invariably served to demonstrate in an unanswerable manner, the very remarkable degree of mechanical efficiency to which our products have been brought. ***The history of mechanical refrigeration is our history.***

Head Office: LONDON, ENG.

BIRMINGHAM	GLASGOW	JOHANNESBURG, S.A.
BRISTOL	BOMBAY	SYDNEY, N.S.W.
LIVERPOOL	CALCUTTA	PORT NAPIER, N.Z.

CANADIAN OFFICES
CORISTINE BLDG
MONTREAL



Little Giant Water Turbine

Self-contained Unit

Mounted on vertical or horizontal shafts. Gate consists of single casting, and is trouble proof. Adapted for all heads. Highest efficiency guaranteed.

Write for Catalog. Prices will Interest You.

J. C. WILSON & CO.

Founders and Machinists. GLENORA, ONT.

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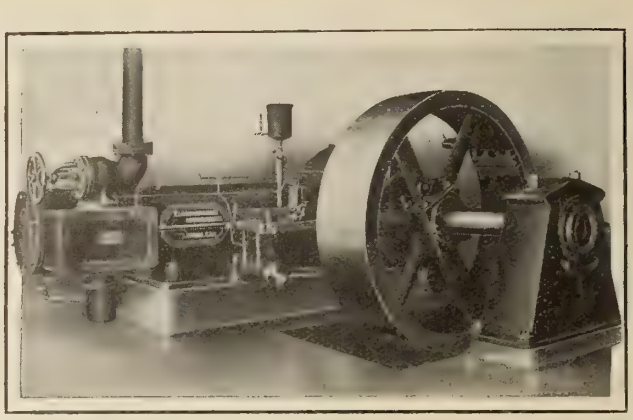


Side Crank Leonard Automatic Engines

Particularly adapted for Direct Dynamo Connection and Electric Light Service. Made in Simple and Compound Units up to 500 Horse Power. For High Economy and Close Regulation this engine is unexcelled.

We also make High and Slow Speed Corliss Engines for Heavy Duty Service. Our "Tangye" Engine is very well and favorably known throughout Canada for Sawmill Work.

MADE BY

E. LEONARD & SONS, LONDON, ONTARIO

MANUFACTURERS OF

High and Slow Speed Engines of all kinds, Boilers, Heaters, Pumps, etc., etc., and complete Steam Plants.

WAREHOUSES AND AGENCIES AT

MONTREAL, ST. JOHN, N. B., CALGARY, WINNIPEG, VANCOUVER

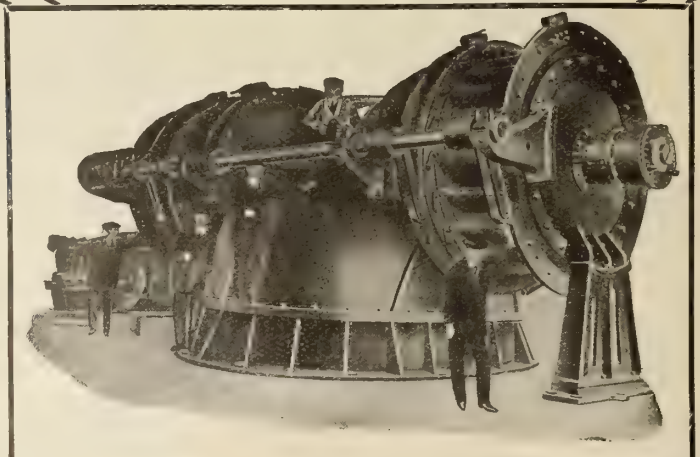
WATER TURBINES

—AND—

GOVERNORS

All Sizes

Maximum Efficiency



All Heads

Ideal Control

ASK FOR PARTICULARS FROM

THE CANADIAN BOVING CO., LTD.

164 BAY STREET, TORONTO.

Branch Office for British Columbia, 427 Seymour St., Vancouver

The advertiser would like to know where you saw his advertisement—tell him.

ESTABLISHED 1870.

JOHN ROBSON, (Shipley), Ltd.

SHIPLEY, Yorks, England.

Sole Makers of the **"Robson" Oil Engine** for working on Crude and Petroleum Oils.

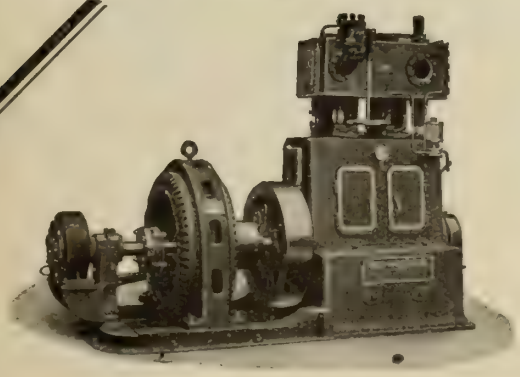
Sole Makers of the **"Robson" Engine** for working on Towns and Suction Gas.

Photograph of Gas Engine and Suction Gas Producer Plant

Suction Gas Producer Plants for working on Anthracite Coal, Coke or Charcoal.

AGENTS WANTED. **WRITE FOR CATALOGUE.**

THE NEW YEAR



is a good time to look over your power plant equipment—a good time to consider remodelling or building. Dependable service all the time is a characteristic of all

ROBB VERTICAL COMPOUND ENGINES

They are also high speed for direct-connection to standard electric generators, pumps, etc. They are economical, silent-running self-lubricating—in fact just what you want for main engine or auxiliary in your power plant.

SEND FOR BULLETIN 201

International Engineering Works, Limited

Owners of Works formerly of

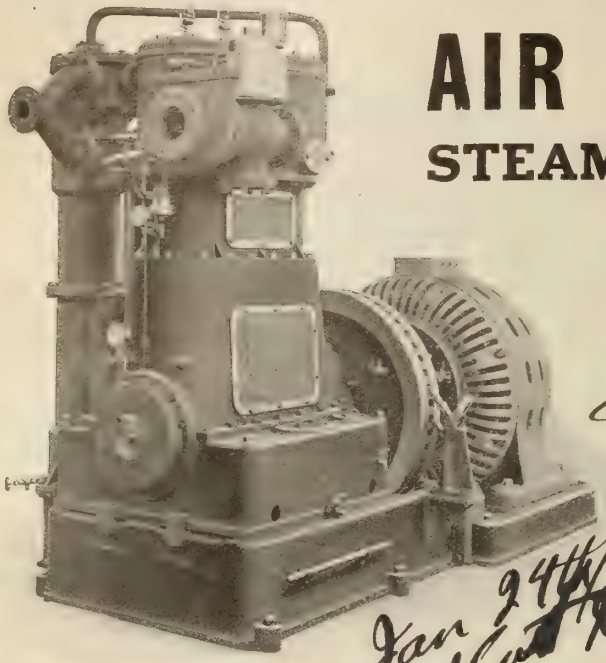
ROBB ENGINEERING COMPANY

AMHERST, N.S., CANADA **SOUTH FRAMINGHAM, MASS.**

SOLE CANADIAN AGENTS FOR
C. A. PARSONS & COMPANY, Newcastle-on-Tyne
Turbines, Turbo-Electric Generators, Turbo Pumps
Blowers and Compressors.

39-40

DISTRICT OFFICES:
Canadian Express Bldg., Montreal, R. W Robb, Manager
Traders Bank Bldg., Toronto, Wm. McKay - "
Union Bank Bldg., Winnipeg, Wm. F. Porter, "
Grain Exchange Bldg., Calgary, J. F. Porter - "



MOTOR DRIVEN COMPRESSOR

AIR COMPRESSORS
STEAM OR MOTOR DRIVEN

High Speed—Forced Lubricated—Patent Noiseless Valves, no unnecessary motion

Resulting in

Low Cost For Upkeep

Duplicate Units as above in Plants of
Messrs. Warden King Co., Montreal.
Trans-Contintental Ry., Transcona.
City of London, Ont.

Jan 24th/13 Last Delivered by W. Walker

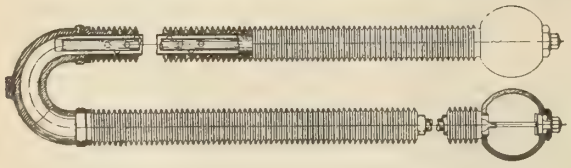
Manufactured by Messrs. BELLISS & MORCOM, BIRMINGHAM, England.

AGENTS—

LAURIE & LAMB

211-12 BOARD OF TRADE **MONTREAL**

FOSTER SUPERHEATERS



Can be Fitted to any Type of Boiler

We have installed them in the following Plants in Canada, viz:

Winnipeg St. Ry. - -	6515 H.P.
Canadian Loco. Co. -	750 H.P.
Can. Steel Foundries -	750 H.P,
Dom. Bridge Co. - -	750 H.P.
Price Bros. - - - -	2560 H.P.

and many others.

Not necessary to flood the Foster Superheater. Absolutely fool-proof.

Manufactured by
Power Specialty Co., N.Y,

AGENTS—

Laurie & Lamb

211-12 Board of Trade **MONTREAL**

"PATERSON" OIL ELIMINATOR

No Separator on the Exhaust Main **Ever Removed all trace of Oil** from the steam.

Nothing but absolute elimination should be tolerated, where the water is to be used as feed in boilers.

Perhaps, you allow all the drips, etc., to run to waste owing to presence of oil in water. In plants where water is paid for, this waste is a serious item.

We guarantee to remove all trace of oil in water of condensation, and you can avoid all waste by the installation of a

Paterson Oil Eliminator

Manufactured by
Messrs. Paterson Engineering Co., London, E.C.

AGENTS—

Laurie & Lamb

211-12 Board of Trade **MONTREAL**

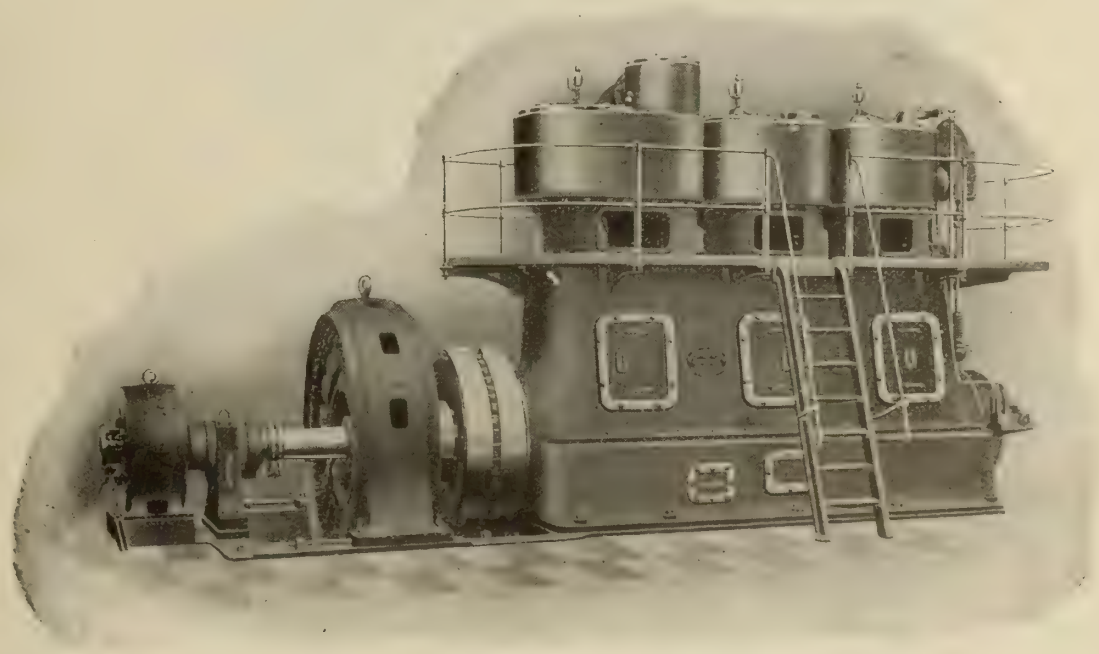
The advertiser would like to know where you saw his advertisement—tell him.

The "Browett-Lindley"

Quick Revolution, Forced Lubrication, Double Acting Steam Engines

Simple ***Efficient*** ***Economical***

These engines have established a high reputation in electric light and tramway plants, collieries, cotton and paper mills, steel and iron works, etc., and are made in five different styles to suit steam pressure and working conditions.



Three-crank, Triple Expansion, "Browett-Lindley" Engine driving 500 K.W. Generator.

Sole Agents for Canada:

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., Limited

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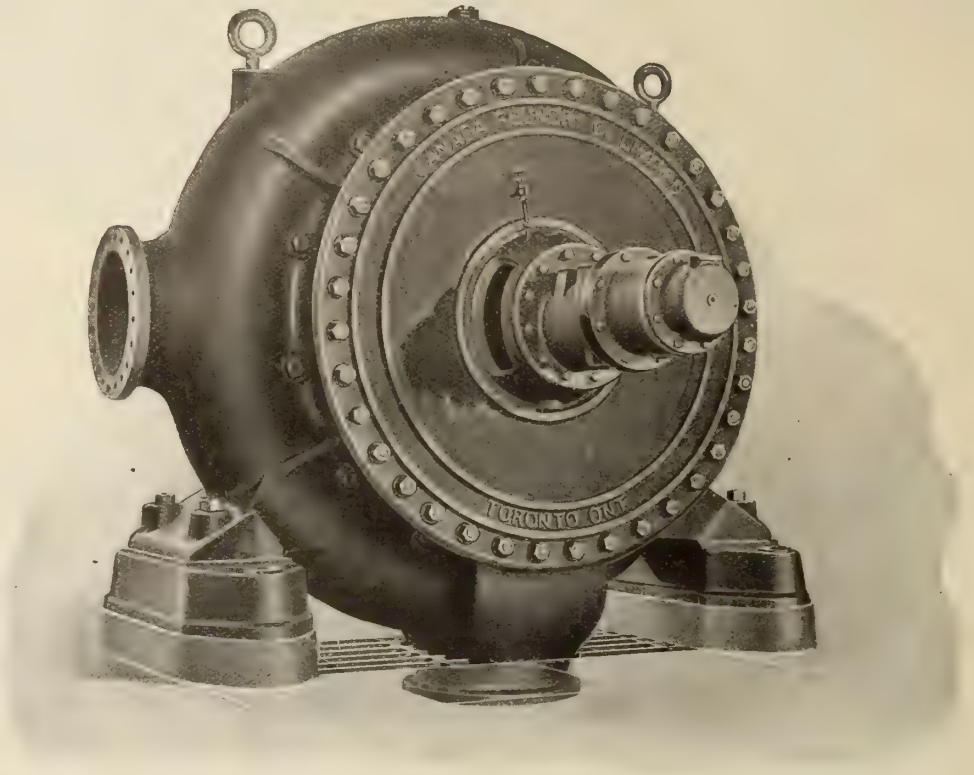
For All Duties



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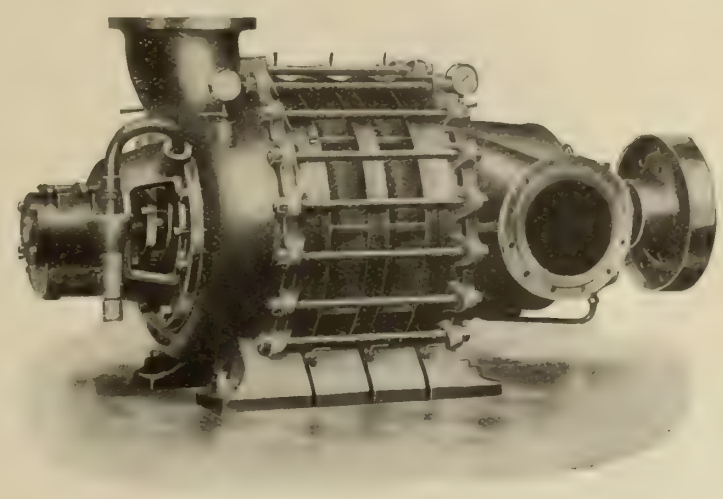

"CONQUEROR" PUMPING MACHINERY

Illustration shows "Conqueror" Turbine Pump, 2650 Imperial gallons per minute, 370 ft. head, 900 revolutions per minute, 450 B.H.P. Motor—for

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The advertiser would like to know where you saw his advertisement—tell him.

ECONOMY and SERVICE

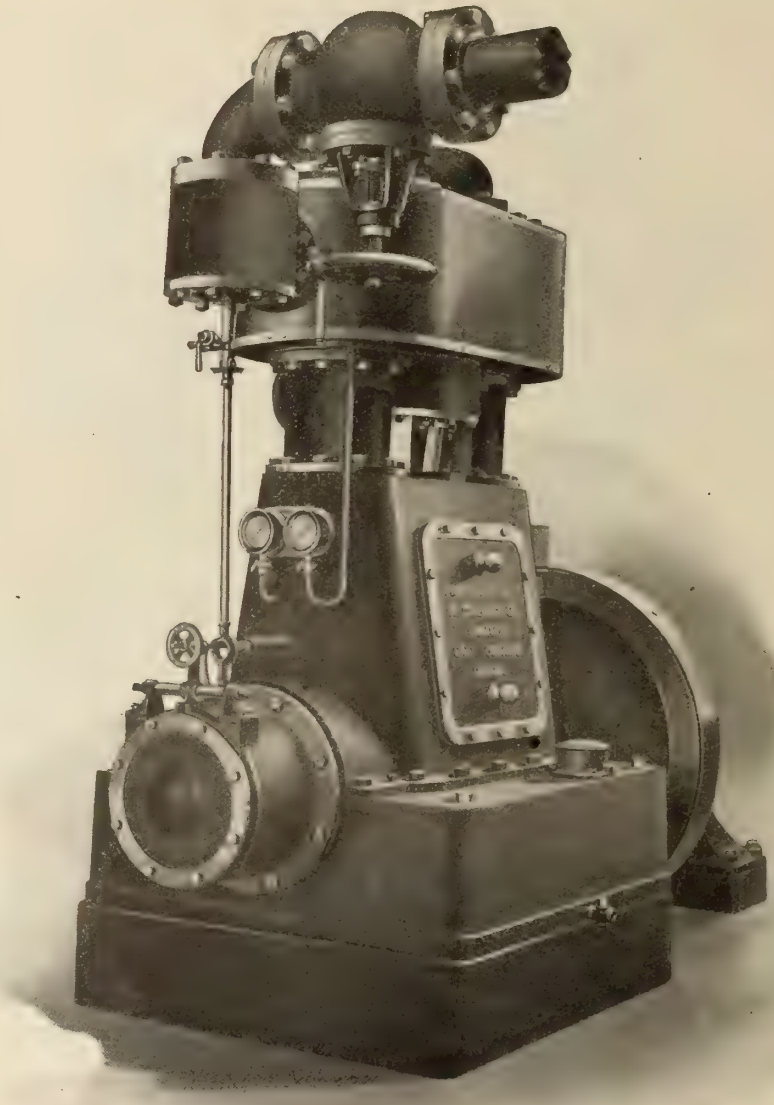
are the two most important considerations

IN THE RUNNING OF YOUR POWER PLANT

Is your present equipment running as economically as it might be ?
Are you getting the Maximum Service ?

G. & McC. VERTICAL HIGH SPEED ENGINES

will give you, as they are giving others, a maximum service all the time, with a minimum cost of upkeep, and they require very little attention while running.



Are equipped with Forced Lubrication Systems. Run practically without vibration, are noiseless, and all working parts are very easy of access. They will save you money.

Twin Vertical, Forced Lubrication Steam Engine

ALL MATERIALS TESTED TO BRITISH ADMIRALTY REQUIREMENTS

The Goldie & McCulloch Co., Limited

GALT, ONTARIO CANADA

WESTERN BRANCH
248 McDermott Ave., Winnipeg. Man.

MARITIME PROVINCES
13-15 Dock Street, St. John, N.B.

QUEBEC AGENTS
Ross & Greig, 412 St. James Street, Montreal, Que.

BRITISH COLUMBIA AGENTS
Robt. Hamilton & Co., Vancouver, B.C.

The George White & Sons Company, London, Ontario

Staff Article

A description of the works of an old established firm building threshing machinery, traction engines, etc. The plant has been gradually built up to its present size, the foundry being the latest addition. The company maintain two branches in the West and have agencies in all the principal cities and towns in the grain growing districts of Canada.

THE George White & Sons Co., Ltd., are well known as makers of high-class portable traction and stationary engines and grain threshing machinery; and their outfits may be found in all parts of the prairie provinces and also Eastern Canada. They have a fine plant at London, Ont., and large warehouses at Brandon, Man., and Moose Jaw, Sask. The firm has grown up from small beginnings, having been founded by Mr. Geo. White, Sr., who came to Canada from Devonshire, England, in 1856, with practically no capital at his command. He settled in London, Ont., and immediately secured land at what is now 71-76 King St. East, for which he had to give a mortgage. Mr. White here commenced the building of wagons, buggies and light agricultural machinery. A few years later he took up the manufacture of small stationary engines and boilers and, as time went on, developed a portable engine for threshing purposes.

The business at King Street continued to extend, and in 1890 the patterns, templets and goodwill of the McPherson Mfg. Co., of Fingal, Ont., for the manufacture of grain threshing machinery, were purchased. This gave a fresh impetus to the business which continued to steadily increase during the next ten or twelve years, in which period Mr. Geo. White gradually took his numerous family of sons into the business with him.

By 1904, the company found themselves very much cramped in their King Street premises and it became necessary to move to more spacious quarters. A suitable site was secured in the eastern part of the city, alongside the Grand Trunk Railway tracks. Here the nucleus of a large engineering works was at once erected and has been gradually added to, until it reached its present size at the end of 1911, when the present foundry was built. The plant covers an area of about 9 acres and consists of four main buildings, viz: planing mill and separator shop, finished stores building, engineering shop, and office building. Their relative positions are shown on the plan of the works.

VIEW OF WORKS. THE GEO. WHITE & SONS, CO., LTD., LONDON, ONT.

The Planing Mill.

The planing mill is in a brick building 200 ft. long by 140 ft. wide. It is divided into two parts, each 100 ft. long, by a brick wall fitted with fire doors. One half forms the planing mill and has one storey only, while the other half is a two storey building and forms the separator (thresher) department. On the upper floor of the latter, the lighter parts, such as chaffers, are manufactured; while the framing and heavier parts are made, and the whole machine assembled on the ground floor. The shop has large window areas and artificial illumination is by 150-watt tungsten lamps. An illustration of the planing mill is given on page 62. It is a well-lighted shop and contains a full equipment of modern wood-working machinery. The latter is operated from line shafting, the whole shop being driven by a small horizontal Corliss steam engine. Each machine has its cutters provided with a hood connected to a central exhaust fan, which gathers up all chips and sawdust and delivers same to the boilers which supply steam for the engine. This building is heated by indirect radiation on the overhead system, the installation having been put in by Sheldons, Ltd., Galt. The shop is lighted by incandescent gas arcs, supplemented by drop lights at each individual machine.

Finished Stores.

This is a brick building, 211 x 133 ft., with a saw tooth roof of five pitches. Here are stored, previous to shipment, the finished traction engines, threshers, portable engines, etc. Along the north side of the building is a depressed standard gauge track for shipping purposes. This track brings the flat cars on a level with the floor, enabling the thresh-

ing engines, etc., to be easily run onto them.

The Main Shop.

The main shop is built of hollow concrete blocks, as made by the Ideal Concrete Machinery Co., and is in the shape of the letter U, the two legs pointing north. The east leg forms the foundry and the west leg the boiler shop, blacksmith shop and erecting shop and stock room, while the connecting bay is the machine shop. A railway siding runs across the top end of the east and west legs, so that pig iron for the foundry and steel bars, plates, etc., for the boiler shop and smithy, are unloaded at the nearest point to their eventual destination.

The west bay, as above mentioned, is divided into several departments, viz., the boiler shop, blacksmith and wheel shop, and erecting shop. Each shop is of heavy mill construction and is in three bays; a glazed monitor roof running the whole length of the building. The centre bay is served by a 10-ton electric crane operated from floor level. This is by Geo. Anderson & Co., Ltd., Montreal, and by means of special crane doors can pass out at the north end of the building in order to unload material from cars on the track outside. The middle bay of the shop is not much used for manufacturing purposes, but forms a crane midway for the transference of material from one department to another. Manufacturing is therefore carried on principally in the two side bays only, each department being separated from its neighbors by partition walls. These run out into the centre bay, it having been the original intention to provide doors between each section of the shop. However, there would have been no great advantage gained by so doing, and the idea was never carried out.

This west leg of the building measures 248 feet long by 100 ft. wide, the side bays being 37 ft. and the centre bay 26 ft. Heating is by indirect radiation on the Sheldon system. A concrete duct runs down the middle of each shop and 15-inch tile ducts branch off from this to the foot of every alternate column, the bases of which are formed of a hollow casting with large openings on opposite sides. In this way the heated air issues at floor level with very efficient and economical results. Economy in heating is especially important here, since the shop is electrically driven by power purchased from outside sources; consequently, there is no exhaust steam available for heating and live steam has to be generated for the purpose.

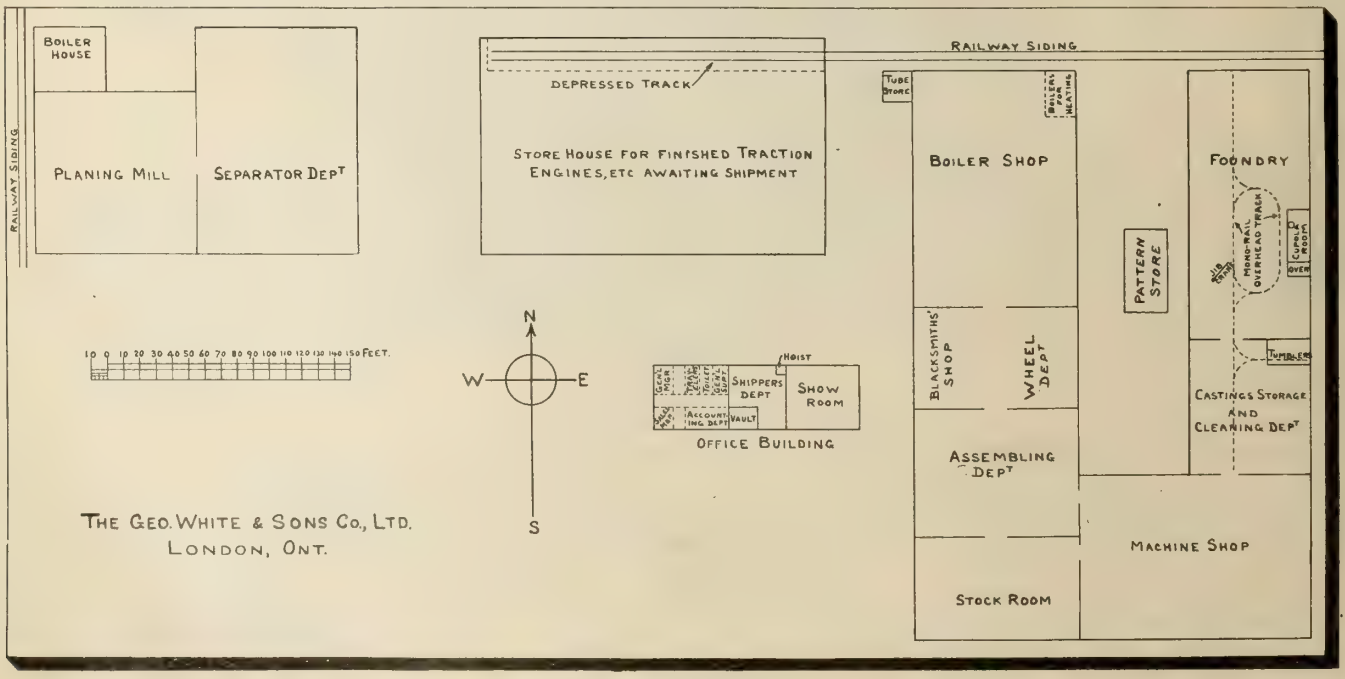
All departments in this main building are artificially lighted by 400 c.p. gas arcs, with the exception of the foundry.

The Boiler Shop.

The boiler work turned out by the company impresses one very favorably,

A VIEW IN THE MACHINE SHOP.

INTERIOR OF PLANING MILL.



LAYOUT OF THE PLANT.

the workmanship and general finish being of a high order. The orderliness of the shop is also very noticeable; all plates are stored vertically in neat racks of W. I. pipe and are classified according to their thickness and future use. The boiler makers and boilersmiths work on the west side of the shop, while in the opposite bay are the rolls, punches, etc. The equipment is all belt-driven and includes a McGregor-Gourlay punch, with 48-inch throat; Lennox rotary bevel shear; flanging clamp; plate bending rolls, etc., etc. These are served by two light hand travelers which run the full length of the bay.

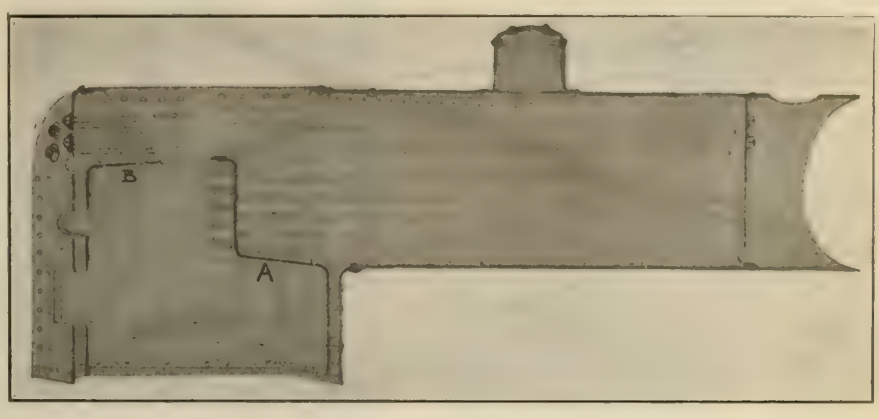
Reaming, riveting, chipping and caulking are done by pneumatic tools, the outfit including Boyer holders-on and riveting hammers, Cleveland chipping hammers and Monarch air drills.

In addition to building the ordinary locomotive type of boiler, the Geo. White & Sons Co. make a similar boiler for burning straw, which has proved very popular in the Canadian West. In this boiler the fire-box, instead of being square, has the upper part of the flue sheet set back about 20 inches towards the rear end of the box, as may be seen in the sectional view on this page. The boiler thus has what the company term a double crown sheet, the lower sheet being seen at (A) and the upper at (B). Immediately inside of the fire door is fitted a dead plate which occupies the back end of the fire box, and from this straw grates extend to the front end. Draft dampers are so arranged that air can be admitted at either or both ends of the fire box as may be required. The straw is burned on the grates immediately beneath the lower crown sheet (A), from which baffle plates extend to within six inches of the rear end of the box. Passing around these baffle plates, the flame comes in contact with the upper crown sheet (B) and then passes into the flues, which by reason of the peculiar formation of the fire box are twenty inches longer than in a square fire box of the same overall length. This gives the boiler a greatly increased heating surface, while its weight is increased very little and its size not at all.

The Blacksmith Shop.

This department, 63 x 100 ft., also presents a very orderly and neat appearance. bars, angles and other material being neatly stacked in such a way that they may be easily got at. There are five forges, two being specially adapted for heating rings and bar work generally. The work is of a light character, so that a single No. 7 Beaudry belt-driven power hammer answers all requirements. In the south-west corner of the shop is the air compressor—a Rand two-stage machine of 400 cubic feet capacity. This is belt-driven by a 65 H.P. A. C. Lancashire motor, and provides air for the boiler shop, assembling shop, foundry, etc.

The east bay of this department forms the wheel shop and here the heavy road wheels are assembled. The rims are made from steel plate, and the spokes from steel bar securely riveted to rim and hub. The latter is a malleable casting of substantial design. The large "bull" gear wheel, by which motion is transmitted from the engine to the road wheels, is fitted on a turned journal and drives the road wheel by dogs fitting between the spring housings. This makes an efficient cushion for taking up shocks that would otherwise be transmitted to the gearing.



THE WHITE SPECIAL STRAW BURNING BOILER.

This department has a jib crane centrally placed to serve a large portion of the floor. There is also a hydraulic wheel press for pressing crank discs upon their shafts and for forcing in crank pins.

Assembling Department.

The assembling department measures 100 x 79 ft. and takes care of the erection of new work and also the repair of old engines. The east bay roof is carried by a double row of columns in order to support crane runways. This bay forms the erecting shop for new engines and three of its bays are equipped with overhead travelers running transversely across the shop. These travelers were built by Geo. Anderson & Co., Ltd., Montreal, and are each of 15 feet span and 4 tons capacity. Their longitudinal and cross-traversing motions are operated by hand from floor level, while the hoisting motion is by electric power.

In the west bay old engines are repaired and new engines tested in steam, for which latter purpose there are four smoke jacks for carrying off the smoke and exhaust steam. For repair work there is a central jib crane for lifting cylinders, crank shafts, etc. When it is necessary to lift the boiler, the engine is run into the middle bay, where the 10-ton traveler can reach it.

After being steamed, the engines are painted, and then pass out into the yard outside. From thence they go to the finished store-house, being towed by a

INTERIOR OF BOILER SHOP.

traction engine which here serves the purpose of a yard "dinkey engine."

The Machine Shop.

The south leg of the building forms the stock room and machine shop. The former measures 100 x 63 ft. and is fitted up with the usual racks and shelves for the convenient accommodation of finished and semi-finished material. Here, too, is situated the Sheldon heating apparatus which warms the machine shop and the west leg of the building. The stock room is divided from the machine shop by a wall fitted with fire doors.

A view of one corner of the machine shop is seen on page 2. The floor area measures 100 x 142 ft., the width being divided into a bay of 25 ft. and two side bays of 37 ft. 6 in.

The north bay is chiefly used for bench work, pipe work, and storage of material waiting to go to the erecting shop. The machine tool equipment is operated from two lines of shafting driven by motors. It is of the usual type met with in a shop of this description and includes a fine 36 x 36 in. x 12 ft. planer by John Stirk & Sons, Halifax, England. This was installed about 18 months ago, as was also a 52 inch boring mill by the Baush Machine Tool Co.

Cylinders have the crosshead guide cast integral with them and both are bored at the one setting on a McKechnie-Bertram lathe. One frequently meets with these old lathes still being used for accurate work in different parts of the country, and the fact speaks well for the careful workmanship originally put into them.

The Foundry.

The foundry building is the most recent addition to the plant and went into operation at the end of 1911. It forms the east leg of the main building and is 257 feet long by 75 feet wide, divided by a wall into two parts. The larger part forms the foundry proper and the smaller the castings, storage and cleaning department. The foundry is at the north end of the building and is 174 ft. long by 75 ft. wide. It is of the same general style of construction as the boiler shop, erecting shop, etc., except that the columns are of heavy 6-inch, W.I. pipe, instead of timber. The heating apparatus here was also manufactured by Sheldons, Ltd., and is carried on an overhead platform at the north end of the shop. The heated air is delivered to the foot of alternate columns by underground ducts. similarly to the other shops. Artificial lighting is by 250-watt tungsten lamps.

The foundry has two side bays 26 ft. 6 in. wide and a centre bay of 22 ft. There is a monitor roof the full width of this centre bay with side windows which can be opened or closed from floor level. The cupola room is in the east bay and contains a 42-inch Calumet cupola of the double tuyere type. A comparatively soft blast is used (8 to 9 ozs.), since the cupola is of ample size for the needs of the foundry and never requires to be

A VIEW IN THE ASSEMBLING DEPARTMENT.

INTERIOR VIEW OF FOUNDRY LOOKING SOUTH.
Note the overhead Mono-Rail Runway which here takes the place of a Traveling Crane.

forced. The blast is supplied by a No. 8 Sheldon Noiseless Fan.

The driving gears used on all the traction engines are made from a semi-steel mixture containing 25 per cent. of steel scrap. The daily cast averages 7 tons, including about 1 ton of semi-steel, which is always run off first. In melting the semi-steel, the coke bed is, of course, first made up and immediately on top of it is put a layer of ⅜-inch steel plate scrap. On top of this comes the pig iron and then the cast iron scrap and returns (sprues, etc.) The steel scrap, as above mentioned, constitutes 25 per cent. of the total charge.

No dry sand moulds are made, so that one small oven, for core drying, is sufficient for the needs of the shop. This is situated alongside the cupola room and is fired by coke in the usual way. The oven is fitted with shelves and in order to fully utilize all the available space there is a truck with several tiers of shelves, which can be run in on a narrow gauge track. A similar track along the east wall of the foundry, north of the cupola room, brings in pig, scrap and coke from the yard outside and delivers same to the charging platform elevator. South of the cupola room, the east bay is occupied by the core makers, while north of it, light floor moulding is done. The north end of the west bay is taken up by ten bench moulders, the rest of this bay being given over to the heavier floor work, for which purpose it is equipped with a 14 ft. jib crane. No very large castings are made, the heaviest weighing about 800 lbs. The machine moulding equipment includes two Farwell squeezers, two Osborne straight-draw machines and one Pridmore roll-over machine.

The middle bay is not used for moulding but forms a midway for the transfer of castings to the cleaning department and for the passage of ladles up and down the shop. It is equipped with an overhead mono-rail runway installed by W. D. Beath & Son, Ltd., Toronto. This runs the whole length of the foundry and cleaning room, with a switch into the tumbler room. The runway is indicated by dotted lines on the plan of the foundry—see page 4—and it will be noticed that it forms a loop in front of the cupola. By this means, ladles of molten metal up to 2 tons in weight are quickly transferred from the cupola to any part of the foundry. At the light moulding floor the metal is poured from the large ladle into hand ladles, and at the heavy floor the large ladle is transferred bodily to the jib crane. In this way the carrying of metal from the cupola to the various floors by hand is entirely eliminated.

The runway may be clearly seen in the half-tone illustration of the interior of the foundry. It has a capacity of 2 tons on each trolley and consists of a 10-inch I-beam. There are nine junction switches arranged in groups of three each, permitting a trolley coming from a branch line on to the main line to turn to right or left, and at the same time leave the main line intact. The junction switch on a "Beath" runway has no moving parts. The trolley is fitted with a guiding bar by means of which the operator can direct the course of the trolley to right or left at the switch, without the necessity of stopping. This feature is particularly valuable where one man following another wishes to switch to a different track. The trolleys are fitted with "New Departure" ball bearings and are of the bogie or swivel type, enabling them to travel round sharp curves with a minimum of friction.

The Cleaning Department.

At the south end of the foundry, and divided therefrom by a wall, is the cleaning room and finished castings storage. It measures 82 x 75 ft. and is singularly free from the dust and dirt usually associated with a cleaning department. This is accounted for in part by the fact that only the larger castings are cleaned here, the smaller ones being treated in two tumbling mills fitted with dust exhausters and located in a special department in the north-east corner of the shop. Here, too, are found the emery grinders, so that all dust is localised.

The south end of the cleaning room is fitted up with racks and shelves for finished castings which are here stored preparatory to going to the machine shop. A small space on the east side is set apart for a few pattern makers. The company have a very complete line of patterns on hand for their various lines, so that they have no need of a regular pattern shop at present.

Patterns are stored in a two storey concrete fire-proof building measuring 47 x 27 ft. The location of this may be seen on the plan.

Office Building, Etc.

This building is handsomely furnished in quarter oak, with separate offices for the heads of each department. The ground floor of the rear half of the building forms the shipping clerks department and also a show room where one of the firm's standard separators, with its sides removed to show the working parts, is always available for inspection. It is operated by belt from a motor. The upper floor forms a store room for finished repair parts, a large number of which are always on hand so that customers may be enabled to make good an accident with a minimum of delay. There is also a small drawing office on this floor.

The officials of the company are:
George White, Sen.—President.
Arthur W. White—General Manager.
Fred. J. White—Sales Manager.
H. B. White—General Superintendent
H. F. White—Assist. Superintendent.
E. A. White—Accountant.
George. E. White—Western Manager.

LONDON & PORT STANLEY RY.

"MY conclusion is that the London & Port Stanley Railway has demonstrated itself to be insolvent, and , therefore, impossible, as a steam road, and to put it into proper operating conditions as such would obviously be but to increase its annual deficit." Such is the report of Mr. Wm. S. Murray, chief engineer of the New York & New Haven Railway.

As to the question of steam and electric lines operating conjointly, he says that his road has been doing this for five years successfully, and that "there is nothing awkward or physically difficult in the case of the London & Port Stanley Railway as regards necessity of maintaining connections with steam roads."

With regard to the estimated cost of $890,000, Mr. Murray does not give a decided answer.

POWER TRANSMISSION OF BELTS.

THERE are cases when one cannot escape a leather belt. In such an event, don't be guided by the pulley face as to your size of belt. Mr. R. Berry's paper on the transmission of power by belting was discussed before the Birmingham Association of Mechanical Engineers a short time ago, and this is his rule: "Multiply the band speed in feet per minute by the width in inches, the result will be total energy in watts that the band can safely be relied on to transmit.

The Wheeler Condenser & Engineering Co., Carteret, N.J., announce that they have acquired the American license to build turbo air pumps of the A.E.G. Type as manufactured in Europe by the Allgemeine Electricitaets Gesellschaft. This air pump is of the rotary water jet type, for motor or steam turbine drive, air being removed from the condenser by the ejector action of a series of small water jets and also by the positive entrapment of air between successive small slugs of water. A number of these pumps are now under construction at the works of the Wheeler Condenser & Engineering Co., Carteret, N.J.

The Design of Vertical Quick Revolution Engines

This type of prime mover has been a very popular one for many years in Europe, where it is often erroneously termed a "High Speed" engine. A more correct name is "Quick Revolution" engine, since, owing to the short stroke, the piston speed is about the same as that generally found in slow speed practice. An engine of this type is now being built in Canada by the Goldie & McCulloch Co.

IN VIEW of the modern demand for higher speeds and pressures and the increasing popularity and success of the vertical quick running forced lubrication engine in this country, the following remarks may not be out of place as regards some of the more prominent features in its design, and some of the reasons for the steadily advancing demand for it as a prime mover, especially in connection with direct coupled electric generators for all classes of work. This type of engine has been developed and improved until it can now compete with all modern engines that use steam as their working medium. At the present moment about 70 per cent. of the power stations in Great Britain are equipped with it. It is also universally used by the great ocean steamship companies, and the British and Foreign Admiralties for ship-lighting and other auxiliary purposes, not only on the score of economy, but also on account of the very small space required even for large powers, absolute reliability, absence of vibration, saving in oil, minimum of attention needed, and the very few and light repairs required and these perhaps only once in several years. Engines of this type have been known to run for seven years without any of the bearings having been taken up, the wear at the end of that period being so small that it could only be detected by means of a micrometer. In some of the earlier British types of 15 to 20 years ago slide valves and expansion (automatic) governing were used; but of recent years these have both been discarded, experience having shown them to be not well adapted to smooth running and long life; slide valves being specially objectionable when highly superheated steam is used.

Systems of Governing.

Piston valves, and either simple throttle governing, or throttle and expansion governing combined, are now universally adopted; but in the latter case both principles are capable of being varied independently of each other and without having to alter the governor. The best types of modern vertical engines employ both principles, in conjunction with an ordinary spring loaded centrifugal governor; but the operation of the expansion principle is totally different from that used with the inertia type of governor in which the governor has to carry the weight of H.P. eccentric, eccentric rod, spindle, and valve. With the centrifugal governor none of the weight of these parts comes on the governor, which can therefore be comparatively small, and lends itself easily to change of speed whilst running,—a very desirable feature when engine-driven generators are being operated in parallel, and one not very easily attained with the inertia type of governor. In large engines the H.P. valve is controlled and the cut-off altered by a small oil or steam relay cylinder with differential floating lever, on the principle so largely used in steam turbine work, and on steering engines, brake engines, etc. The governor has only to operate a small balanced piston valve, an inch or two in diameter, which controls the supply of steam or oil to each end of the relay cylinder. In smaller engines a simpler arrangement is used, but the principle is the same.

The late Mr. Willans was amongst the first to prove that the combination of expansion and throttle governing is more economical than either method alone, especially on very variable loads; and the results of his careful tests and research work have since been more than confirmed by other investigators and in actual practice. It may be stated generally that expansion governing is the more economical down to about one half load, and throttle governing from one half load downward, the gain in economy under the latter principle being partly due to the decreased range of temperature in the cylinders and partly to the fact that the compression does not increase as the load decreases, as is the case with purely automatic governing. By using little compression a great gain is made in the area of the indicator card, and therefore in the work done by a given amount of steam.

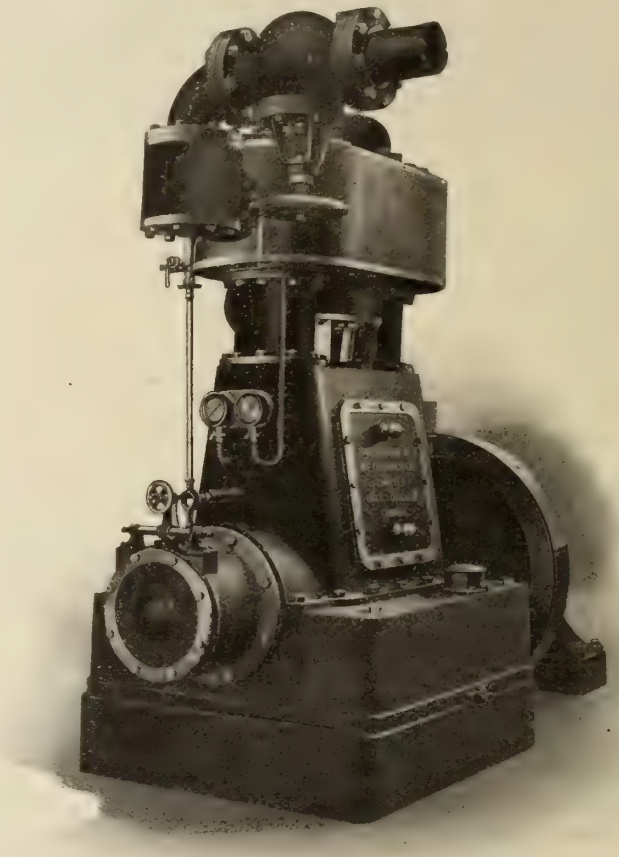


FIG. 1.—GOLDIE & McCULLOCH VERTICAL TWIN CYLINDER FORCED LUBRICATION ENGINE,—SPECIALLY ADAPTED FOR LOW STEAM PRESSURES AND HIGH BACK PRESSURES.

Reduction of Cylinder Condensation.

Among other points that tend to economy in the vertical quick revolution engine is the shortness of the cylinders, and, in two cylinder engines of good de-

sign, the absence of any pipes between same, the radiation surfaces being therefore much reduced. Likewise, owing to the short stroke and high speed, the temperature of the cylinder walls is more nearly constant than in a large slow speed engine with very early cut-off

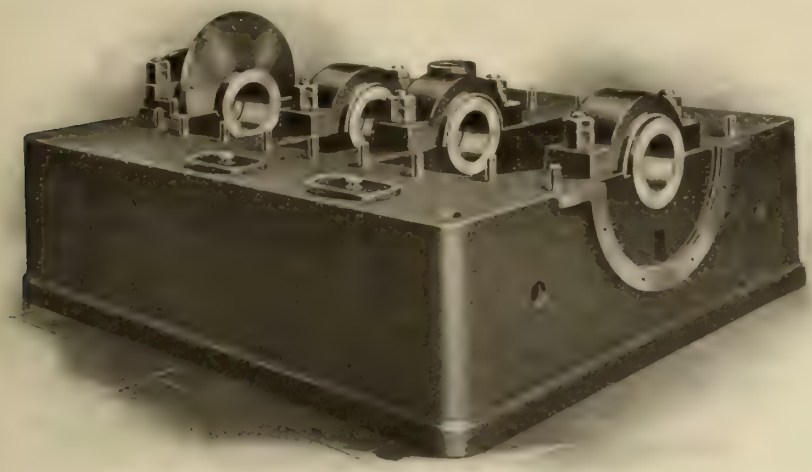


FIG. 2.—BEDPLATE OF THE ENGINE WITH BEARINGS IN POSITION.

and high ratio of expansion, where the cylinder walls have more time to cool between strokes and the range of temperature is greater.

The foregoing features materially reduce cylinder condensation, which is one of the chief sources of loss. Another point is that piston valves are much more steam tight at high speeds than at slow, a valve that may leak considerably at a comparatively slow speed becoming practically steam tight at a high one. This has been proved by much patient experimental and research work in various countries.

The characteristic steam consumption curve of a compound or triple expansion engine employing both throttle and expansion governing, is a very flat one, which means good economy on a load ranging over wide limits. In fact these engines are primarily designed to meet "average" running conditions, which is the true basis on which the commercial economy of any plant should be measured.

The Importance of Accurate Balancing.

To ensure a silent running engine at high speeds and with small compression it is necessary that the reciprocating parts be kept as light as possible; this is attained by using special construction and only materials of the very highest quality. Balance also, is most important and each line of similar moving parts should be exactly the same weight. In a two cylinder compound engine for example, the cranks are opposite each other, and the L.P. piston is made either a steel forging or casting according to size, steeply coned and a mere shell in thickness compared to what it would have to be if made of cast iron. The H.P. piston may be made of cast iron as it will be much deeper than the L.P. to be of equal weight. The weight of the valves, etc., should also be as nearly as possible equal. With piston rings—as with slide valves and automatic governing—it has been a case of the survival of the fittest, one of the few types that have proved satisfactory being the celebrated "Rowans" ring so extensively used in marine and locomotive work. For superheated steam the rings in the H.P. cylinder should be of the "restrained" type, or else a solid deep "floating" ring on the principle of piston valves, the cylinders being lapped out after boring and the rings ground up to suit. Ordinary snap (or Ramsbottom) rings, unless of the "restrained" type, only lead to trouble and excessive wear, both of themselves and the cylinder walls, when used with highly superheated steam. For high superheats, the H.P. cylinder, with its valve and bushings, must be made of specially hard metal. Given two similar engines one running at 100 R.P.M. and the other at 400 R.P.M. the disturbances due to centrifugal force in the latter will be 16 times as great as in the other, since they vary as the square of the speed. The best way to reduce these disturbances is to keep down the weight, as they vary directly as the weight.

Lightness of running parts also minimises the inertia couples and reduces vibration. Inertia couples due to the reciprocating masses tend to make the engine pitch vertically, and centrifugal couples due to rotating masses tend to make the crank shaft centre trace out two conical surfaces with their common apex between the cylinders and having the original crank shaft centre as axis. Both these couples are reduced as much as possible by keeping the cylinder centres closer together, as is attained in the design, shown in Fig. 1. If two similar vertical engines, one throttle governed at light loads and the other expansion governed, are indicated at equal light loads, the indicator cards corrected for inertia, and the crank effort diagram plotted for one revolution, it will be found that the co-efficient of fluctuation of energy in the expansion governed engine will be double that of the throttle governed, thus illustrating the more uniform turning effort of the latter.

Design of Detail Parts.

Amongst the points to which special attention should be paid are the eccentrics and valve rod pins, which must have very large surfaces, if cool and quiet running and long life are desired. It must also be remembered that though the piston speeds in fast running engines are about the same as in slow speed practice, yet the speed of the valves is practically doubled, as it is impossible to reduce the valve travel much if quick opening and closing and free steam passage are desired. Consequently the valve spindles should be very stiff and have large rubbing surfaces in their glands and guides. All other bearing surfaces in these engines should be much larger in proportion than for slow speed work; and with ample surfaces and a

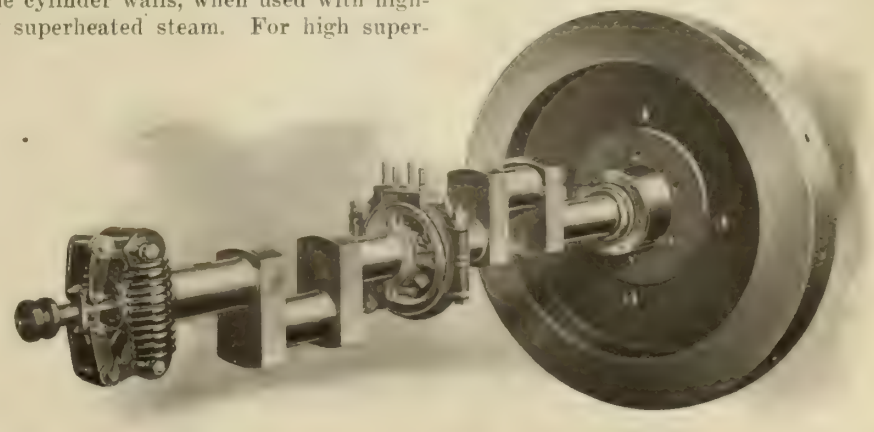


FIG. 3.—CRANK SHAFT WITH GOVERNOR, ECCENTRIC AND FLY-WHEEL ASSEMBLED.

practically perfect oiling system, the running clearances may be much closer than with ordinary work, this in itself helping to eliminate knocking or pounding.

Lubrication.

As the success of high speed work, given good design, materials and workmanship, depends entirely on the forced lubrication principle, this must deserve the name. It is on the maintenance, against all odds, of a film of oil between all rubbing or rotating surfaces that the success of the system, in eliminating wear and producing silent running, depends. To this end the pump must be of the simplest form and is universally of the valveless type and driven from one of the eccentrics. A strainer should be fitted on the suction side to prevent any dirt being carried into the bearings and the working pressure should be from 15 to 20 lbs. to the square inch. A properly designed and proportioned lubricating system means a high mechanical efficiency. An automatic oil and water separator is a desirable fixture, as it prevents waste of oil from the piston and valve rod wiper glands, and also automatically discharges any water that may come down these rods. Water in the oil deteriorates the latter and may also cause knocking in the forced lubrication system. A separator of this type is seen on the right of the engine bed in Fig. 1.

Goldie & McCulloch Vertical Engines.

The well known firm of Goldie & McCulloch, Galt, Ont., have recently developed a quick revolution vertical engine designed along the lines set forth above, and one of these is illustrated in Fig. 1. Various component parts of the engine are shown in Fig. 2 and 3.

We hope to further describe and illustrate these engines in a later issue, as we understand that Messrs Goldie & McCulloch are making a specialty of them and are very busy with orders, having upwards of 4,000 B.H.P. on order at the present time. They also inform us that all materials used are subjected to British Admiralty tests—about the most severe in the world—before acceptance and all engines are thoroughly tested under steam and necessary adjustments made before shipping. The high reputation of the firm and the many years experience they have had in building horizontal high speed piston valve engines, many hundreds of which are in operation all over Canada, augurs well for the success of their vertical engines, which embody all the best features of modern design and practice.

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The Canadian Union Electric Co., who opened an office in Montreal about ten months ago are now preparing to open up in Toronto.

PASSENGER MOTOR CAR DEADWEIGHT.

SOME interesting comparisons were drawn by the author of a paper read recently before the Canadian Railway Club. Attention was called to the fact that a horse-drawn vehicle, seating on an average four passengers and a driver, weighs from 1,500 lbs. to 2,500 lbs., which gives a deadweight per passenger of from 300 lbs. to 500 lbs. Such a vehicle will move at a speed of from six to eight miles per hour over a road not comparable with the worst type of railway track. Again, a motor car weighing five tons and seating seven passengers and containing its own power plant, moving with almost the same average speed as a passenger train over a far inferior road bed, gives a deadweight per passenger of about 1,428 lbs. The deadweight per passenger of a steel railway coach built after American ideas varies from 1,200 lbs to 1,700 lbs., and admitting the points of superior comfort and safety to be balanced by the poor road bed and the weight of the power plant of the motor car, the question arises as to whether any possibility exists of getting below the motor car limits of deadweight per passenger, and is this reduction possible without sacrificing safety and comfort?

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..THE APPRENTICE ENGINEER.

MR. SUMMERS HUNTER, in a recent address, said:—In an engineering works the apprentices appear to be divided into two classes, those who take advantage of all the facilities we can give them, and who work conscientiously in the shops and out of them—thus we get a small proportion of clever young fellows who will undoubtedly rise to all that is required in the future. Then there is the other class, who will eventually become our skilled workmen. We must give our attention to all, because it is just as necessary to have thoroughly skilled and well-trained workmen as it is to have the more highly educated, a number of whom will take more responsible positions.

I have apprentices in our works now who came from schools, where, at the age of 15 or so, they go on the science and engineering side for three years. At the age of 18 or 19 these lads are well grounded in science. They have had experience in the running and testing of steam engines, gas and oil engines, turbines, electrical apparatus, and even a certain amount of practical training under skilled workmen. Personally, I have got the best results from the lads who, after leaving school, go into the shops for a year, and after that divide their time between technical colleges and the works. Of course, this is a system that cannot be applied to the ordinary apprentice; at the same time, ordinary apprentices can take advantage of the system by qualifying at evening classes. I believe six months in the works and six months at college for three or four years would be found, on the whole, to give the best results. I am dealing now with mechanical engineering as quite apart from civil.

For the majority of apprentices who have to learn a specific trade, I believe more can be done in the future than we have attempted in the past. I have found a certain percentage of apprentices quite deserving of special education or training in practical work, and in the future I shall give more attention to this, for more accuracy is being called for, and we must produce skillful workmen who can make the best and most methodical use of the machinery and apparatus in the works. I have the greatest admiration for the mechanic who is able to turn his hand to any job about an engine, but as with the leaders, so with the workmen, men of special training will be required.

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ST. CATHARINES' CITY ENGINEER

MR. W. P. NEAR, Toronto, who is now city engineer of St. Catharines, is a young man, who has crowded sufficient activity into his career to satisfy a much older one. He was born in St. Mary's, Ont., and educated at the High School there, and at the University of Toronto. He specialized in mathematics, and won the degree of B.A.Sc. Practical experience followed theory. He worked on boundary surveys in Alaska, and later was busy in southern British Columbia. Coming nearer home, the young engineer devoted a year to the Temiskaming and Northern Ontario Railway.

The year 1905 witnessed the Eclipse expedition to Labrador. A total eclipse of the sun brought about this interesting journey, and Mr. Near was a member of the party that made it. His scientific wanderings terminated three and a half years ago, when he joined the main drainage department, as a member of the Toronto city engineering staff. Since then, for half the time, he has had charge of construction.

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The Canadian North-West Steel Co., Ltd., manufacturers of structural steel, have built a fabricating plant at Vancouver, which has a capacity of approximately 1,000 tons of fabricated material per month. A stock of from four to five thousand tons will be carried. The new plant commenced operations the first of the year.

ARE LARGE POWER STATIONS A MISTAKE?

ARE large power stations a mistake, asks W. H. Booth, in the "Electrical Times." To a fuel economist the large power station presents itself as a means whereby one-tenth of the calorific capacity of fuel is converted into electricity and nine-tenths are employed to heat water or air, both of which are wasted so far as regards their heat contents. Seeing that every centre of population demands large amounts of low temperature heat, this waste points to that modern evil of lack of industrial co-ordination in the utilization of national resources which is so pointed a feature in an age which prates a good deal of commercial economics and boasts of the conservation of the national resources. Obviously, there must be huge gaps in our knowledge or in our capacity, so long as these wastes continue.

In the United States, in the early days of electric lighting, some power stations, it is believed, were run as non-condensing stations in order that the waste product, steam, could be sent round the locality about the station, there being a demand for such waste heat, especially in winter. Twenty-five years ago or more there was a steam raising plant specially installed in Greenwich Avenue, New York City, from which steam was distributed in well insulated pipes for heating offices, tenements, and other buildings. In America, as here, the big station craze has had its way, and such stations are placed always where there is water access for condensing purposes, and no attempts are made to use the immense by-product of heat. It is clear, that given an outlet for such heat, there is no occasion to employ condensing methods. With a sale for the heat, all the present power could be produced from the same engines by adding to the admission period in the cylinder. Economy of steam would not be worth striving after if no steam remained unsold.

Oil Fuel and Diesel Engine Installations.

It is now being suggested that with oil fuel and Diesel engines it may be possible to generate electricity for lighting and power purposes at large numbers of centres, and that the waste heat would find ready application in the surrounding area of population. An oil-driven power station would be economical in smaller sizes than the minimum size of economical steam station, and it would be free from the dirt incidental to a steam-driven plant. How such a scheme of combined heat using could be carried out need not here be discussed. Sufficient that there are such methods which offer a practical solution of the problem. The distribution of cheap power gas, in properly jointed steel gas-tight pipes under pressure, to such small power stations would be equally available as a solution, pending the approaching era of cheaper oil fuel said to be looming in a not too distant future. Electricity is shorn of half its benefits where its production involves the use of means which waste nine-tenths of the fuel energy. Were there no visible uses for the wasted energy, the present state of affairs might remain unchallenged, and everyone might rest under the shadow of the thermodynamic law of which the academicians make so very much, forgetting that thermo-dynamics apply only to the engine and do not matter to the householder, or the laundry, or other mere heat user.

Power Generation From Gas.

Under the fetish of the law everyone appears to be content to run 90 per cent. of coal energy to waste just because the steam engine cannot use it. Central stations for gas production, where residuals can be saved, are correct practice, and it is correct to use the gas for power production at comparatively small scattered stations. With this, the proper use for gas, it would soon begin to disappear as an illuminant, for electricity, fortified by the commercial value of the now wasted heat, would be too unquestionably cheap to admit of any argument. The gas and the electrical lion and lamb would lie peaceably side by side.

The North-East coast of England has, during the past few years shown us something of what it is possible to attain by more or less co-operative effort in the fuller uses of the heat energy of coal, but the stoppage at the limits set by the thermo-dynamic law shuts off the enormously greater field which can only be utilized where there are aggregations of population contiguous to the waste heat producers. The concentration of power production in huge units precludes any possibility of using any serious amount of waste heat. To carry electricity from such stations for conversion into heat except for comparatively small and incidental uses cannot appeal to anybody. By converting coal into gas and by-products, all unsightly work could be relegated to a few huge stations, and the waste heat of power production could be generated close to the homes of the users of that power. Thus, at one stroke, the domestic dirt and smoke production would be abolished, electric lighting would be fractionalized in cost, it would cease to be a waste of fuel to use electrical energy for heating or cooking, and all small suburban industries of the laundry order would cease to burn coal and produce smoke. Cheap gas and cheap electricity would be available side by side for the uses each was best fitted to satisfy.

Under engineering conditions as at present existing, electric light is produced from coal, and 90 per cent. of heat energy is wasted. Power is produced in electrical shape, and 90 per cent. is wasted of the fuel energy. Thousands of laundries use coal at 20 to 50 per cent. efficiency; millions of houses use coal at 1 to 20 per cent. efficiency. Water supply is pumped at an efficiency of a few per cent., the wasted 90 per cent. of heat going into the water which passes the surface condensers, and may occasionally help to do good by preventing freezing of mains. In all these uses the valuable bye-products of coal are all wasted. These can best be produced on a big scale at great producer stations of cheap gas, where the waste heat of gas production would usefully be employed in the residual works.

LOCOMOTIVE BLAST PIPE.

A PROPERLY designed variable blast pipe is an acquisition to a locomotive, and if used intelligently, economy and a higher general efficiency in the performance of the engine are the result. According to the **Railway Gazette** an engineer has recently stated that while studying the question of locomotive design and operation abroad, he frequently rode on French locomotives, and noticed particularly the degree of refinement obtained in the steam distribution of four-cylinder compound engines. At speeds of from 56 to 62 miles an hour it was noticed that by a slight adjustment of the valve gear, which resulted in lowering the back pressure on the low-pressure pistons, the engine immediately increased its speed by about nine miles per hour, without taking any more steam from the boiler or increasing the regulator opening. The same engineer has also expressed the opinion that superheated locomotives would give an even higher efficiency than they do at present if fitted with variable blast pipe nozzles, and that wherever four-cylinder compounding is resorted to, there should of a certainty be an independent adjustment possible between the high-pressure and low-pressure valve gears.

NO AGE LIMIT TO MOTOR TRUCKS?

IF there is a limit to the life of a motor truck it has not as yet been determined. A large department store in London is operating 22 motor vehicles, which have traveled a total of 1,110,000 miles, or an average of 50,000 miles for each vehicle. One of these vehicles has averaged close to 12,000 miles per year for eight years, and its owners state that it is giving just as good service to-day as it did at the beginning.

ROTARY CONVERTERS AT C.P.R. DOCKS, FORT WILLIAM.

THE following installation of two 600 K.W. Westinghouse rotary converters with necessary accessory equipment of transformers, equalizing generator, etc., was made during the past summer for use by the Canadian Pacific Railway at their new coal handling docks, Fort William.

Power is received at 25,000 volts from a 3 phase, 60 cycle line, and transformed through two sets of three 200-K.W. single phase transformers, oil insulated, water cooled, 60 cycle, star-connected primary 14,500 volts, delta-connected secondary 178 volts. At the latter voltage, it is delivered to the two 600 K.W. 6 phase rotary converters shown in Fig. 1. These machines give 250|280 volt D.C., 2400 amp. at 600 R.P.M., and are connected in parallel to the D.C. bus bars. As the load is a rapidly fluctuating one, special provision had to be made to handle the peak loads. This has been very successfully taken care of by the use of a fly wheel direct connected to a D.C. machine which alternately operates as a generator or motor across the D.C. bus bars; being perhaps the first application of this system to the unloading of coal.

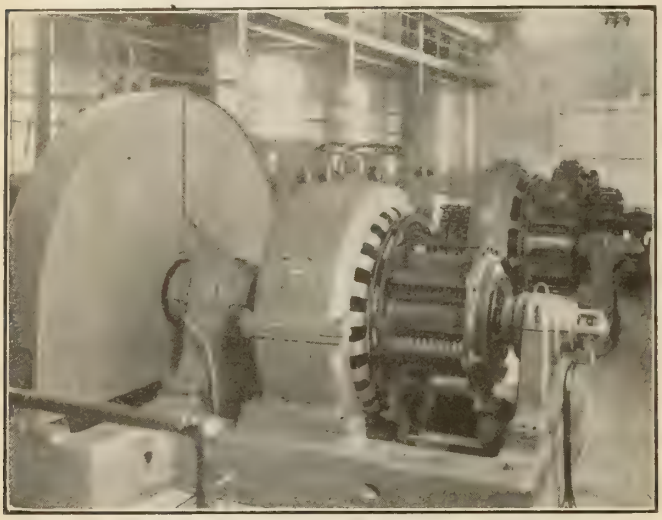

FIG. 1—ROTARY CONVERTERS AT C.P.R. DOCKS, FORT WILLIAM, ONT.

D.C. Equalizing Machine.

The D. C. equalizing machine is rated at 400 K.W., 250 volts compound wound, and is capable of handling heavy overloads for short periods. The direct connected fly wheel weighs 15 tons, and is made up of solid steel plates. This gives a high factor of safety. It is enclosed by a heavy steel plate cover. This machine has a speed variation of from 450 to 600 R.P.M. depending on what load is being taken from the D.C. bus bars. On light load, the set automatically speeds up, taking power from the line, but with a heavy load on the line, the speed tends to fall off and the generator feeds back on the line taking power from the fly wheel. This speed variation is obtained by changing the shunt field resistance through a water rheostat, which is operated by the special torque motor shown in lower part of Fig. 2.

Lightning protection is afforded by air cooled choke coils and a three-phase type "A" electrolytic lightning arrester designed in this case for use on a 25,000 volt line. In Fig 2, the arrester tanks are shown mounted in the gallery. This picture also gives a good idea of the open nature of the high tension bus bar arrangement. The bus bars are connected to the incoming line and to the transformers through type "E" 35,000 volt, three-pole, hand operated, automatic, oil circuit breakers shown in Fig. 4.

FIG. 3. ROTARY CONVERTERS AT C.P.R. DOCKS, FORT WILLIAM, ONT.

Besides the transformers supplying power to the converters, there are two 3-phase transformers for A.C. power purposes. They are rated at 100 K.W. and transform from 25,000 volt primary to 2,200 volt secondary.

Switchboards.

The switchboards are of black marine-finished slate mounted on angle iron frame. A total of 17 panels has been installed. The control panel for the incoming line is shown in Fig. 3, in front of the transformer, while on either side of it are the panels controlling the A.C. side of the rotary converters. At the left of illustration, Fig. 2, is shown the D.C. control board, while the board at the right controls the 3-phase transformers. Mr. R. S. Kelsch was Consulting Engineer and the equipment was manufactured by the Canadian Westinghouse Company at their Hamilton works.

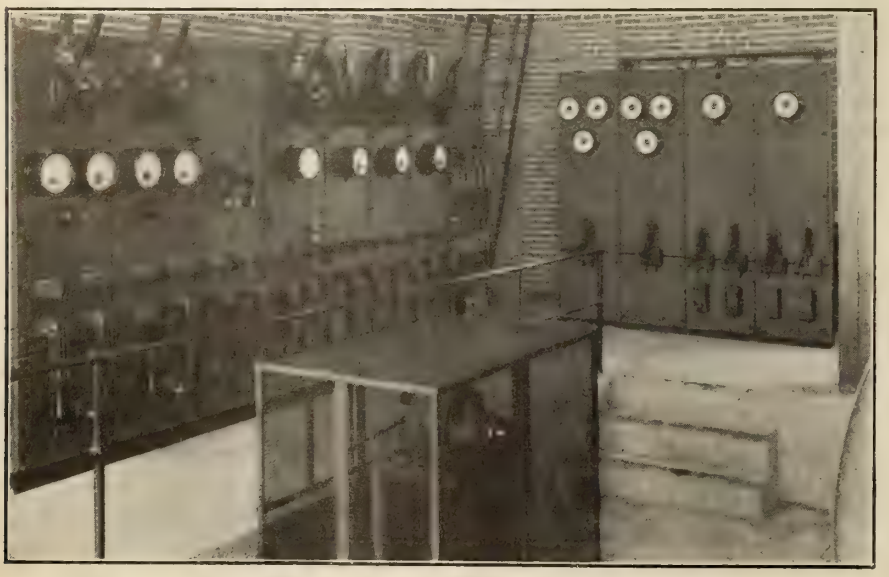

FIG. 2. ROTARY CONVERTERS AT C. P.R. DOCKS, FORT WILLIAM, ONT.

AUXILIARY STEAM ENGINES.

By W. T. Wardale, A.M.I.E.E.

IN many manufacturing plants, especially where electricity is not used for driving, there are many duties, such as

driving pumps, fans, condensers, etc., performed by small steam engines. It is often asserted, especially by men keen on the electrical drive, that these small engines are unavoidably very wasteful. That they do consume a large amount of steam per horse-power is true, but that they need not be extremely costly as auxiliaries if they are properly installed will be shown.

Exhaust to Feed Water.

Usually this type of engine is accepted as wasteful, or else it is attempted to minimise the waste by exhausting to a condenser. The waste is foolish, and the remedy, paradoxical as it may seem, is mistaken. All auxiliaries of a steam plant should exhaust to a feed water heater. The reason being that we use steam because it is a very convenient medium by which to carry the heat in the fuel from the boiler furnace to the engine, and the various auxiliary services can be obtained for a less expenditure of heat by exhausting these engines to a feed-water heater than by condensing, the capital cost being at the same time kept lower.

FIG. 4. ROTARY CONVERTERS AT C.P.R. DOCKS, FORT WILLIAM, ONT.

Consider a plant of 1,000 horse-power. This plant if modern will deliver a brake horse for 15 lb. per hour. Assume that the condenser is separately driven and that it takes 3 per cent. of the main engine power, viz., 30 horse. Very often in such cases, a compound enclosed high-speed engine working on the condenser is installed. A good result from so small an engine is a consumption of 25 lb. per brake horse per hour, a total hourly consumption of 750 lb. If a vacuum of 25 inches is maintained, the condensed steam will not be delivered to the hot well at 120 deg. Fah.; thus the cost of working the condensing plant in this way is:—Heat units in steam delivered to engine, minus heat units given up to boiler feed water in hot well. Let the pressure at the engine stop valve be 150 lb. to the square inch, then the total heat units supplied to the engine will be 895,125, and the heat units recovered in the feed water will be 750×120, the temperature of the hot well. This gives 90,000 heat units recovered, and a net total of 805,125 heat units to run the condensing plant. There should be added the work absorbed in condensing the exhaust from the condensing plant engine; this, however, being small, may be omitted.

Typical Example.

Now, consider the total cost in heat units of working the condenser with a single-cylinder engine using 45 lb. of steam per brake horse per hour. The engine should be supplied with steam through a reducing valve at, say, 70 lb. pressure. By this means the steam will be delivered to the engine very dry, and, perhaps, even superheated a little—due to the throttling action of the reducing valve. When worked through a reducing valve, any apparatus on the low-pressure side should be fitted with a presure gauge and safety valve, the latter set to blow at 2 lb. to 3 lb. above the working low pressure. By having the engine exhaust to a feed-water heater, the total heat units supplied to engine will be 1,611,225. The engine will exhaust at 2 lb. to 3 lb. above atmosphere, and the steam delivered to the heater will leave as water at 180 deg. Fah.; every pound of exhaust steam giving up to the feed water 968 units of heat. The total so given up will be 1,307,000 heat units, making the net consumption 204,225, or about one-fourth the amount used with the condensing engine. Such, however, is not all the benefit derived from exhausting to the feed heater, for not only will the feed be raised from 120 deg. Fah. to about 200 degs. Fah., but the water which drains from the heater can be run into the hot well and so add to the economy, the only loss between the heater drain and the hot well being that due to condensation and radiation, and this can be made very small by lagging the pipes. One large plant has used this system for years, and the calculations are given from experience.

The Main Engine Feature.

It may be asked if such economy can be obtained with the auxiliaries by this method why not recommend the main engine to be run this way? The explanation is simple. With the auxiliaries the greater part of the heat can be recovered from the exhaust and passed into the feed water; with the main engine, however, the feed water alone is unable to absorb a large proportion of the heat in the exhaust even if inconveniently large heaters were used, and even then the amount of steam which would have to be exhausted into the atmosphere would not allow sufficient heat to be recovered by the feed water to compensate for the extra steam consumed by the engine. The boiler feed for the whole plant is, however, able to absorb nearly all the heat in the auxiliary exhausts when a feed heater is used; on the other hand, when the auxiliaries are run on the condenser, the "latent" heat of the auxiliary exhaust steam is given up to and carried away by the condenser circulating water.

Wasted heat units mean wasted coal. The merits of the above system were proved at a test on a 1,400 horse-power plant in Lancashire, when changing the auxiliary exhausts from the condenser to the feed heater resulted in the auxiliary plant being run on less than one-sixth the steam previously used. Simple auxiliary engines cost much less to buy and maintain and do not impair the vacuum on the main engine by leakages at small glands and drain cocks as small compound condensing engines are liable to do.—The foregoing formed a contribution to the "Practical Engineer," of London, England.

CIVIL ENGINEERS' DINNER.

THE first annual dinner of the Victoria and Vancouver branches of the Canadian Society of Civil Engineers was held December 14, in the Balmoral Hotel. Speeches were delivered by prominent members of the profession. Mr. F. C. Gamble presided over the gathering, which consisted of about eighty.

After the loyal toasts had been honored with customary zest, the chairman proposed the toast of "Our Country," to which Mr. J. H. Gray responded. In doing so Mr. Gray traced the history of engineering from its earliest record in the Province of British Columbia, stating that the first route line to the Pacific Coast was now the one that was generally recognized as the best. To-day at the Yellowhead Pass they had the G.T.P. and the Canadian Northern. The G.T.P. had scarcely deviated at all from the original route selected by the pioneer engineers of the Province. If for no other reasons than that he thought the people of the Province should have faith in their engineers. "We are endeavoring now," he continued, " to strengthen our position in the public mind, or at any rate give to certain of our fellow-citizens who appear to be weak-kneed in regard to the status of civil engineering in this province, a greater confidence in the home product. The past justifies us in making every claim to be able to handle work of any description that may have to be undertaken in this province.

An Empire Builder.

The toast of the "Civil Engineering Profession was proposed by the chairman, and responded to first by Mr. C. E. Cartright, of Vancouver, formerly of the C.P.R., and secondly by Mr. C. H. Rust, city engineer. Mr. Cartright stated that in modern times the civil engineer had developed into an empire builder. He contended that in the Province of British Columbia the civil enneer had played a very important part. In talking of the future he said that the operations of the G.T.P. and the Canadian Northern would open up great tracts of country hitherto inaccessible for development or settlement.

Mr. Rust, city engineer, said that the Canadian Society now had about three thousand members, as against the paltry three hundred of several years ago. He did not think the people of the country appreciated what they owed to the pioneer engineers of the country, the hardships they had undergone, or the things they had accomplished. He thought they were too modest. Perhaps they did not advertise enough; or they should have been more in politics. The lawyers were all in politics and they appeared to get all that was coming to them, and the medical men were also represented in Parliament, but the engineers remained in the background. He was particularly gratified to see that a civil engineer had been elected Mayor of Winnipeg, and he hoped that a few more of them would aspire to similiar positions.

The toast of the British Columbia Society of Architects, was responded to by Mr. J. C. Keith, and the last toast was "Our Guests," to which Mr. Frame of Penticton, responded.

STEAM TRAPS.

IN a recent address, Mr. George Wilkinson stated that it needs no argument to prove that steam traps are exceedingly wasteful. Reliable and simple apparatus, he maintains, is available for passing the whole of the water of condensation from the steam range back to the boilers direct, at a temperature closely approximating to that of the steam itself. In this way, steam traps, which are the most wasteful devices in a steam equipment, can be entirely dispensed with on the steam range.

It would be interesting to know, says Mr. Wilkinson, why many engineers continue to use the bucket type of steam trap in their works. Each discharge from such a trap produces a violent agitation between the water and the steam, and ensures that the water is discharged into the atmosphere at the highest possible temperature, thus giving the maximum waste of caloric. If traps have to be used at all, they should be of a type where the water, having once formed, remains quiescent during the discharge with a small upper surface only exposed to the heating action of the steam.

A REPEAT ORDER FOR BOILERS.

THE Polson Iron Works, Ltd., are building two boilers, coal hoppers and supports, for the new plant of the Consumers Gas Co., on Eastern avenue, Toronto. They are practically the same as those already installed, being 11 ft. 6 ins., in diameter and 15 ft. long, for 150 lbs. pressure. They have been adopted by the gas company as a standard boiler. Room has been provided for an addition to the present plant.

The firm is also building Heine water tube boilers of 300 h.p. for the Canadian Ammonia Co., Ltd., a Detroit concern, who are building a new plant in Toronto. Some tank work is also being done for the same company.

HEAT ECONOMY.

THE first of a series of three Cantor Lectures on the subject of "Methods of Economizing Heat," was recently delivered by Mr. C. R. Darling at the Society of Arts.

The lecturer, in the first place, referred briefly to the sources of energy not yet tapped to any extent for commercial purposes—solar radiation, tidal energy, the internal heat of the earth, and interatomic energy—and expressed the opinion that these sources would be utilized when fuel supplies became scarce. A suggestion was made for a thermal storage battery, in which the heat from the sun was caused to melt a solid, which, by special means, could be kept in a state of surfusion, and which could be made to solidify when required, giving out the stored-up heat.

Dealing with the use of fuels in high-temperature operations, he pointed out that the products of combustion must leave the furnace at a temperature not less than that of the heated object, and that, unless the heat thus escaping could be utilized in a second operation, its loss was unavoidable. In this connection he observed that in the rotary cement kiln, the heat required to produce a proper clinkering temperature could not all be utilized in other parts of the process, and that extension of the length of the kiln beyond a certain point did not remedy the loss.

The question of steam-raising was next considered, and the economic and other advantages of careful stoking pointed out. After describing modern forms of mechanical stokers, special firebars, and accessories, such as flue-pyrometers, and CO_2 recorders, the lecturer stated that in large coal-fired boilers there was now no need to produce smoke, unless an attempt was made to work them beyond their proper capacity. On the other hand, when small hand-fired furnaces were used, a certain amount of smoke was considered inevitable. The advantages of oil fuel for steam-raising, particularly on steamships, were next referred to, and the saving effected by the use of economizers and feed-water heaters in connection with boilers explained. The lecture concluded with a demonstration of the Bonecourt system for the surface combustion of gases, which, applied to a steamboiler, gave a thermal efficiency of over 90 per cent.; and it was suggested that it might be found more economical in the future to extract the gas from coal and use it for steam-raising on this system, selling the valuable by-products, than to burn the coal directly.

WESTINGHOUSE STEAM TURBO-GENERATORS.

ACCORDING to the report of the Committee of the Association of Edison Illuminating Companies on steam turbines, based on information supplied by the manufacturers, a number of developments and improvements have been made recently in Westinghouse steam turbo-generator practice. Speed limits have been materially raised within recent times in both 25-cycle and 60-cycle practice. In 60-cycle practice, generators of 5,000 kilovolt-amperes, rating at 3,600 revolutions per minute, have been built, which is considerably larger than had been completed a year ago. For machines larger than 5,000 kilovolt-amperes, four poles are being used up to approximately 20,000 kilovolt-amperes, whereas a 10,000 kilovolt-amperes generator was about the largest machine yet built with four poles up to a year ago.

In 25-cycle practice two-pole 1,500 revolutions per minute machines are being built in sizes up to 20,000 kilovolt-amperes, and it is probable that the ratings will be carried up to 25,000 kilovolt-amperes or possibly 30,000 kilovolt-amperes, although at these ratings, other factors than the design of the turbo-generator itself may control the speed conditions. It may be said, however, that the generator itself is practicable up to 30,000 kilovolt-amperes at 1,500 revolutions per minute. At 750 revolutions per minute it is hard to say what the upper limit will be.

APPLICATION OF BALL BEARINGS

AN interesting paper entitled "Application of Ball Bearings to Engineering," was recently read before the University of Liverpool Engineering Society. In dealing with the fitting of ball bearings, the author, Mr. George W. Goodchild, remarked that this is a very easy matter, generally speaking. The inner ring should be driven tight on the shaft, while the outer is a push fit in the housing, and should be allowed some side play.

Before mounting, the bearing should be allowed to lie in a bath of oil heated to about 104 deg. Fah., and then driven on the shaft, which should be a shade larger than the bore of the bearing, by a few good blows directed on the inner ring, carefully avoiding hitting the balls or outer race. This is particularly essential if the loads vary considerably, and when the bearing is subject to constant and considerable vibration, such as in crank shafts and rolling mills. It is also necessary for machines running at high speeds, such as electric motors, ventilators, woodworking machines, etc. It is very desirable that the shaft should be ground where it is proposed to fit a ball bearing; furthermore, the inner race should be clamped tightly on the open side, and it is essential that nuts or other parts holding the inner race in position should not come into touch with either cage or balls.

THE UTILIZATION OF PEAT.

A report issued by the Canadian Department of Mines, deals exhaustively with the utilization of peat fuel for the production of power and with experiments conducted at the Fuel Testing Station, Ottawa, the results of which are given in numerous tables and curves. The report consists of about 140 pages, and is divided into two sections. The first section refers to the plant employed, consisting mainly of a 60 h.p. double-zone Korting gas producer, with wet coke scrubber, tar filter and dry scrubber, a Westinghouse 100-h.p. bituminous suction-gas producer, and a 60-h.p. four-cycle, single-acting Korting gas engine, coupled direct to a 50-kw. Westinghouse generator.

New Tar Separator.

The second section contains a description of alterations carried out in the plant in order to eliminate difficulties connected with the formation of tar. These alterations were devised by Mr. F. B. Haanel, the compiler of the report, and involved the design of a new tar separator, in which a cone composed of 40-mesh brass wire is used as a filter in place of a cylinder and perforated plate. The gas, in passing upwards through the cone, deposits some of the tar on the metallic surface, and this is washed off by a water spray from the interior of the cone. The particles of tar that escape contact with the metallic surface of the cone in passing through the meshes are caused to coalesce and to form larger drops, which either adhere to the outside surface of the cone or drop to the bottom of the separator, assisted by another water spray on the outside of the cone. The latter spray is connected by a two-way cock to the return cooling water from the gas engine, and should the suction in the separator begin to rise, the hot water is substituted for the cold, and in this manner the suction, whatever it may be, reaches normal in about a minute. This separator is stated to remove completely the troublesome matter from the gas, and to render the plant an unqualified success, so that operations may be carried on for a week or more without having to shut down for the purpose of cleaning the valves of the engine.

The consumption of fuel per b.h.p. hour, including stand-by losses, is, for full load 1.7 lb. of dry peat, or 2.3 lb. when containing 25 per cent. of moisture; and for three-quarter of load, 2.1 lb. of dry peat, or 2.8 lb. with 25 per cent. of moisture. Assuming that the peat can be delivered to the plant at $2 a ton, and that the plant is run with a power factor of 75 per cent. for 3,000 hours, the fuel cost is $8.40 per b.h.p. year, including stand-by losses. The peat employed varies slightly in composition, according to its source, but that taken from Alfred consists of 30 per cent. moisture, and, when dried, of 30 per cent. fixed carbon, 64.6 per cent. volatile matter, and 5.4 per cent. ash. The calorific value of the dry peat is 9,450 B.Th.U. per lb., and as charged 6,600 B.Th.U. Other details of the different qualities tested are also included, as well as numerous photographs, drawings, and diagrams.

THE CANADIAN COAL OUTPUT.

NOVA SCOTIA and British Columbia will in future have to fight for supremacy in Canadian coal production. Nova Scotia, for many years, has led the way. In 1911, according to the figures of the Department of Mines at Ottawa, that province produced 6,994,000 tons with a value of $14,050,000. British Columbia was second, with over 2,000,000 tons, and a value of nearly $8,000,000. The prediction that the coal mines throughout British Columbia, and particularly on Vancouver Island, will be among the most important in the world, may not prove far wrong.

British Columbia already holds some notable records. Since 1836, for instance, it has produced over 34,000,000 tons of coal, with a value of $109,000,000. In the past ten years its production has exceeded 17,000,000 tons with a value of approximately $55,000,000. When the industry gets the capital necessary for its exploitation, the Pacific Coast Province will be setting records not to be easily surpassed.

Coal Imports.

Despite the large coal resources known to exist in Canada, production in recent years has been only about half the estimated home consumption. The remainder of our requirements are supplied by imports, chiefly from the United States. In 1911, for instance, Canada imported coal classified as follows:

Coal	Tons	Value
Bituminous ...	8,905,815	$18,407,603
Slack	1,632,500	2,090,796
Anthracite .. .	4,020,577	18,794,192
Total ..	14,558,892	$39,292,591

No question as to the existence of markets can be raised. The demand is rapidly increasing as our population grows, and our industrial life quickens,

yet one trouble in a new country which has unlimited natural resources and opportunities, is that certain industries must wait for men and money. The coal industry of the Dominion has been satisfied to a certain extent with both development factors, but can well absorb legitimately many millions of capital and much labor to bring to the surface good coal in almost countless tons.

Statistical Data.

The following figures for several years, taken at random from official returns, show the distribution of British Columbia's coal production in tons.

Year	Production	Home consumption	Sold for export
1900 ..	1,599,851	685,667	914,184
1905 ..	1,737,010	1,089,667	647,343
1909 ..	2,326,899	1,585,232	741,667

Last year 573,888 tons of British Columbia's coal was exported to the United States, and 38,808 tons to other countries.

CENSUS OF CANADA'S INDUSTRIES.

THE information obtained from the census of the manufactures of Canada taken in June, 1911, has just made its appearance in the form of a bulletin from the Government Census Department. Some of the data was made public by Mr. Archibald Blue in a speech at the annual meeting of the Manufacturers' Association in September, but much is entirely new.

The returns show that at the time of the census, Canada had 19,218 manufacturing establishments, with a capital of $1,247,573,609; 215,193 employees; a pay roll of $645,288,733; using raw materials to the value of $601,509,018, and turning out products to the value of $1,165,975,639.

Growth in Ten Years.

In ten years the number of establishments increased by 4,568; capital by $800,000,000; employees by 176,000; wages by $128,000,000; raw materials handled, by $335,000,000, and finished products by $685,000,000.

The extensive development of Canada's industries is indicated by the immense output of some of the establishments. One in Nova Scotia, during 1910, turned out more than eight million dollars' worth of products; one in Ontario, more than nine million dollars' worth, and two in Quebec, more than ten million dollars' worth. There were fourteen establishments which had a production just under seven million dollars each for the year.

Ontario in Lead.

Ontario continues the banner Province for manufacturing, having 6,543 establishments; Quebec comes next with 4,845; Nova Scotia following with 1,188; New Brunswick, 919; British Columbia, 392; Prince Edward Island, 334; Manitoba, 324; Alberta and Saskatchewan together, 105.

The figures indicate that amalgamation was practised in Ontario to a very large extent, as during the last five years the number of manufacturing establishments increased by only five, while the total capitalization of the Ontario manufacturing companies increased by $200,000,000, the number of employees by fifty thousand, the amount of wages paid by $55,000,000, and the total production by $210,000,000.

In Quebec, the number of establishments showed an increase of 1,619 in five years; the total capitalization $71,000,000; the number of employees, 39,000; the wages paid them $22,000,000, while the total production of the factories showed an increase of $131,000,000.

Alberta Ahead in Product Value.

The Province with the highest rate of increase in the value of products during the last ten years was Alberta, with 1,331 per cent.; the amount of increase being $17,500,000. During the same time, Manitoba increased in manufactured products by $41,000.000 or 315 per cent.; British Columbia increased by $46,000,000 or 235 per cent.; Quebec by $192,000,000, or 121 per cent.; Ontario by $338,000,000, or 140 per cent.; Saskatchewan by $5,680,000, or 871 per cent.

Fourteen Leading Cities.

Among the cities, Montreal continues in the first place as a manufacturing centre. In 1910, the value of manufactured products in Montreal proper was $166,000,000, an increase of 146 per cent. in twenty years. However, including Maisonneuve, Westmount, and Lachine, which are essentially a part of the Montreal industrial centre, the value of the production for the year was $115,000,000, which is an increase of 168 per cent. in twenty years.

The value of production in Toronto was $154,000,000, an increase of 234 per cent. in twenty years. Hamilton takes third place as a Canadian manufacturing centre, with a production of $65,125,000; Winnipeg is fourth with a production of $32,694,000; Ottawa fifth with $20,954,000; Quebec sixth with $17,149,000; London seventh with $16,273,000; Brantford eighth with $15,070,000; Vancouver ninth with $15,866,000; Halifax tenth with $12,140,000; St. John eleventh with $10,089,000; Sydney twelfth with $9,395,000; Berlin thirteenth with $9,266,000; Calgary fourteenth with $7,751,000.

BAD TOOLS MAKE GOOD WORKMEN.

AT a time when practically all the great centres of engineering instruction are naturally proud of their admirable equipment, it may seem hypercritical, or even ridiculous, to question whether much of the expenditure on machines and machine tools does not really react to the detriment of the pupil. However, these things do not stand still. Where there has been expenditure in the past, there will be further expenditur in the future, and I merely ask that some consideration should be given to the views of one who has experience in teaching the elements of engineering subjects, since these views tend to encourage economy in one direction, which would presumably leave more money free for expenditure on other branches, in which it may be that such expenditure would bear better fruit.

The Best Engineer an Opportunist.

The firm belief on which I base my contention is that the best engineers are great opportunists; men who make the most of the appliances at their command, and are not discouraged when they are called upon to carry out a job which appears to be beyond the commonly accepted capabilities of the implements at their disposal. When a tailshaft breaks in mid-ocean, it is not to be expected that the engineers on board the vessel will have the help of all the ideal appliances for carrying out a repair, but the man who does the thing somehow saves the cost of salvage. When emergencies arise—and an active engineer's life is more or less full of emergencies—they have to be dealt with as best they can at the moment, and under such conditions I would sooner rely upon a man who can keep going an engine which properly belongs to the scrap heap than upon one who fully understands the possibilities of the most complex and marvellous automatic machine tools, and despises whatever is not recognized as representative of modern practice.

Only recently, the principal of a great college of science told me that he had been discussing with a former pupil, who has now made his mark in the engineering world, the value of his scientific training, and had asked what part of his college course had been of most value to him. The reply was that he had learnt most from a casual incident. A member of the staff of the college had occasion to move a power launch between two points overland, and the ingenious means employed to overcome various difficulties of transit as they arose had provided the pupil with ideas which he had successfully translated into action time after time in his subsequent career.

At another place I remember a batch of engineering students being freed from lectures for a couple of days for a somewhat similar purpose. A ten-ton cutter had come ashore, and the owner wished to beach her for repairs on the spot. The shore was very steep, and the coastguards and the local boat builders assured him that the job could not be done. However, it was done, and done satsifactorily, and I think all those who had a hand in it gathered more useful experience than would have come from a month of ordinary workshop practice.

The Test of Real Ability.

For elementary students I am certain that my theory holds good in the main. Almost any boy can work steadily through the construction of a model engine or a small dynamo with thoroughly adequate tools and the guidance of a skilled instructor: but if the tools are imperfect or insufficient in variety, the teaching of the instructor, who is constantly helping him to devise makeshifts, and showing how difficulties can be overcome by ingenuity rather than by improved machinery, becomes far more helpful and inspiring. The doing of the obvious, or the fulfilment of straightforward work that never presents unexpected difficulties, does not make a real engineer. As a matter of fact, I doubt whether the true engineer is not invariably born as such, but mechanical resource, if it exists at all, can, I believe, be "trained on" by facing and overcoming difficulties, and smothered by having all these difficulties wiped out before the pupil realises their existence. Start trained men on straightforward jobs on good machines and all the results will be practically identical; put them on to imperfect machines and give them imperfect tools and you will soon see which are the true engineers. Some will find out what the machines cannot do while some others are making them do it. This quality of achieving the impossible can never be brought out in a shop so perfectly equipped that all things are possible.

Reliable Mechanics vs. the First-Class Engineer.

There is a big difference, over and above that of mathematical and scientific training, between a reliable mechanic and a good engineer. The one is satisfactory enough provided that he carries out well the work entrusted to him on machines suitable for the work. The other must be always looking ahead and progressing. A combination of high scientific attainments with sound machine shop experience does not necessarily produce a good engineer. What is wanted is a species of instinct; something that tells a man, without conscious reasoning, what ought to be done to improve matters, what is the cause of some trouble, or what will be the result of an experiment not yet tried. Probably every intelligent man has some trace of this instinct, but a first-class engineer has it highly developed. The question is whether this acuteness in mechanical matters is purely a natural attribute, or is capable of being "trained on" to any appreciable extent. If the latter, as I believe, then the young engineer's work should contain unexpected difficulties if it is to be of the greatest possible benefit. Clearly, when he leaves college and goes into works—or if he is on the "sandwich" system during that part of the year when he is employed in works—he cannot have unnecessary pitfalls put in his way without depreciating the value of a commercial product. If this sort of thing is to be done at all it must be done in the college course. If inferior or faulty tools are to be used deliberately it must be upon work on the perfection of which no made reputations depend.

College Equipment Suggestions.

What I should like to see is something in the nature of a pause in the improvement of some parts of the equipment of technical colleges. The tools and machines which go out of date or become faulty and inaccurate under the handling of many beginners, instead of being sold off at scrap prices, might be gathered in a shop specially set apart for them, and in that shop all engineering students should spend some part of their time. The work which they did there, together with particulars of their difficulties and the assistance given to them, would be kept quite separate from their work done in the properly equipped machine shop, and I think ought to be taken into full account in estimating progress and in examination results. It would be helpful, too, in enabling teachers to advise their students as to the branches of the profession best suited to their abilities. It would be found that some men would do astonishingly fine work under bad conditions and yet would not shine elsewhere. Again, students of an almost ideal character, quick and accurate in theoretical work, reliable in practical work, would be found not to possess the curious faculty of getting good from bad, and would be saved from wasting themselves on branches of engineering in which the exercise of this faculty plays a particularly important part.

I should like, also, to see some old—preferably badly designed and badly handled—engines and electrical equipment kept and used in somewhat the same way. Much may be taught from these "awful examples." I well remember one which did excellent service to many generations of engineering students. It was a single-cylinder horizontal steam engine, supplied through about 50 feet of unlagged steam pipe by an antique Scotch boiler working at a painfully low pressure. The steam pipe descended about 12 feet vertically into the steam chest, and the exhaust pipe rose vertically through the roof into the open air. The "swashing" of water could be distinctly heard whenever the engine was at work, and I imagine that a cover would have gone very quickly if the piston and D valve had fitted properly. The comparison of diagrams taken from that engine with those from a modern set in the same shop was very instructive, and it and its boiler were continually useful in showing how things should not be made or fitted up.

Perhaps I am carrying a somewhat revolutionary suggestion rather too far, for I admit that the "handy man" is not the only variety of engineer, and it is the "handy man" who would probably do best in such surroundings. Even so, a very big percentage of engineers still find their greatest asset in resource. If a man has been given a thousand a year at the university, he cannot be expected to settle down very contentedly on the $12 a week that he subsequently earns, and if an engineering student has been accustomed to having at hand the ideal implement for every job he does, he will be equally helpless if he has to face rough and ready work under difficulties. Moreover, it is only by comparison that we learn to appreciate what is good when we get it, and at the same time to realise that even good may be made better by the application of sufficient knowledge or ingenuity.—From a contribution by "Hastatus" in the "Arena" monthly.

HEAT INDICATOR FOR BEARINGS.

A NEW heat indicator introduced by General Electric Co., consists of a paint for application to bearings or other parts of machinery and electrical apparatus. It is normally of a bright vermilion, but on reaching a temperature of 120 degs. Fah. shows a change of color, and at 190 deg. to 210 deg. F. is almost black. When the temperature of the part falls below 120 deg. F., the paint resumes its normal red color. It is claimed that the paint is practically indestructible, that it is unaffected by lubricating oils, that it prevents the formation of rust, and that the warning which it gives enables a machine to be stopped before any damage is done by overheating.

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THE NEW YEAR OUTLOOK.

THE New Year, 1913, in its immediate outlook, gives token of a continuance of the industrial prosperity which formed such a remarkable feature of its predecessor, and should no presently unforeseen conditions arise to disturb the even trend of things, there is every encouragement to believe that in many fields of manufacturing enterprise, record progress and achievement will be accomplished. The features of power and light are inseparable from our existence as a national force in the world's trade, commerce and civilization generally, and our maintenance of at least a competitive supremacy calls for individual and combined effort on the part of all interests engaged in the various activities relative to their production. The year just closed has been remarkable in its record of new and enlarged power plants, and indicates perhaps as effectively in respect of this, when compared with most other features, the progress and development that are taking place in the industrial and manufacturing life of the Dominion.

From a study of the opinions regarding the business outlook forwarded us by a thoroughly representative body of Canadian manufacturers and power plant specialists, the outstanding fact is clearly established that no setback is in immediate prospect, and that the gigantic strides made in progress and development during the past year will form but stepping stones to a still higher degree of achievement in the year on which we have entered. When we consider the number and variety of manufacturing plants which have recently sprung into existence or have been extended and enlarged, and take cognizance of their more or less successful record of competitive production, it is forcibly impressed upon us that not a little glory attaches to our "Captains of Industry," under whose guidance and direction this desirable consummation has been brought about. The note is one of optimism and it strikes a responsive chord in the heart of every citizen of the Dominion. Combined with this optimism, there is unbounded confidence shown in the various enterprises undertaken, and whether we occupy the position of director or operator, there is inspiration to be derived which will impart impetus to our efforts to help in our country's upbuilding.

The descriptive article appearing in last month's issue on the Point du Bois, Winnipeg, Hydro-Electric Power Station, not only emphasizes the need for its establishment, but evidences the desire expressed in its completeness and up-to-dateness of equipment, to have it meet the most exacting demands. With the development and progress of our country, it has ever been our aim to keep pace, and, in the many opportunities afforded to foster the work, our journal has always been in the forefront as a director and guide. The encouragement, support and commendation which we have received at the hands of all ranks and classes engaged in the power field throughout the Dominion and elsewhere during the past year impresses us with a realization that our place and sphere, the fitly filling of which is highly appreciated, demands enterprise equally aggressive, if not more so than the progress of the country itself. Increased effort will, therefore, be put forth by us to merit a continuance of the support, co-operation and encouragement so generously bestowed in the past by our old friends, and to add to our large circle of subscribers and advertisers a host of new supporters.

GAS AND OIL ENGINE PROGRESS

A record of principles of design, construction and achievement in a rapidly developing sphere of power generation.

PETROL, STEAM OR HORSE.

AN interview appears in The Commercial Motor on motor versus horse haulage, with the managing director of a large London brewery, which acquired 12 steam vehicles before the end of 1906, and two years later began to buy petrol vehicles, of which they now possess 12, of carrying capacities from 30 cwt. to 5 tons. They have also 150 horses. "We have found that there is work for both horse and motor; but cannot shut our eyes to the economies that have been effected by the use of the motor. Compared with hiring charges they are cheaper by a full 50 per cent. Our own stable can, of course, work more economically than when we hire, but the motors will undoubtedly show a big saving over horses in a considerable additional portion of our work when we are able to change."

Petrol vehicles are preferred to steamers because they give a wider range of operation, although they have the disadvantage of greater tyre wear; but in tyre wear, the company have effected economy by fitting larger tyres than those supplied by the makers. On relative costs of running, the petrol vehicle was 50 per cent. higher than the steamer, but it gave approximately 33 per cent. more in mileage, while being cleaner in the yard and free from smoking on customers' premises. Any further decided increase of liquid fuel cost would tend to send the company into the hands of the steam vehicle makers. Meanwhile they are in search of petrol substitutes such as paraffin, benzol, or other. In comparative cost of horse and motor delivery, before the adoption of motor vehicles, the cost per barrel per mile seldom came below six cents, and with motor vehicles never exceeds 2 cents.

DIESEL ENGINES IN CANADA.

THE first Diesel oil engine used in Canada was bought by the Town of Yorkton, Sask., in 1910. It was one of 150 h.p. and has proved so satisfactory that another, of 500 h.p. has been ordered by the same town. The Canadian Boving Co., Ltd., are the Canadian representatives of the makers. The contract includes a 400 k.w. generator of Siemens Bros.' make, the whole to be delivered before next fall.

Other Diesel engines on order from the Canadian Boving Co., include one of 500 h.p. for the Moose Jaw Electric Railway, who installed two of 200 h.p. in 1911; two for Battleford, Sask., of 240 h.p. each; one for Melfort, Sask., of 150 h.p.; one for Penticton, B.C., of 200 h.p.: and one of 150 h.p. for the Saskatchewan Clay Products Co., of Moose Jaw. All these engines are just arriving in Canada. The number of large orders shows that the Diesel oil engine is making good headway in this country.

The Canadian Boving Co., Ltd., are just now erecting 2 ten-million-gallon pumps, operating against a 440 foot head, for the Montreal Water and Power Co., being duplicates of pumps delivered last year. This contract includes two direct connected induction motors of 1,300 h.p. each, supplied by the Canadian General Electric Co. The erection of turbines at dam No. 5, Trent Canal, will be completed shortly, and will give the electric power company an additional capacity of 5,000 h.p.

GOVERNING OF OIL ENGINES.

THE governing of oil engines is a point of particular importance, and is often put forward as an objection to their adoption by steam engine makers. There are two principal methods, the one known as the "hit-and-msis," whereby a working stroke of the engine is entirely cut out, and the other by means of which the supply of fuel is regulated to suit the load, and no working strokes are missed. Other methods consist in prematurely opening the exhaust valve or keeping it closed, but these are hardly in general use. On light loads, the hit-and-miss principle has the advantage in fuel consumption, the mixture being kept constant at all loads, whereas with the graduated charge, the mixture may vary and also the amount of compression. Water injection is now generally used, and is found not only to increase the efficiency of the engine, but to allow the compression to be carried to a higher point without increasing the risk of pre-ignition.

WASTE OF NATURAL GAS IN CANADA.

By W. J. D.

MUCH has been written about the saving effected by using natural gas in gas engines to generate power, instead of burning the gas under boilers to generate power from steam. Experiment has shown that the amount of gas required per hour, for the development of one horsepower, varies from 9 cu. ft., with the highest type of large internal combustion engine, to 130 cu. ft. with the ordinary steam engine. In other words, the efficiency of the gas is over fourteen times as great when used in gas engines as when used for generating steam under boilers.

It has also been suggested, in other countries, that provision be made for preventing the use of natural gas for such purposes as lime and brick burning, etc., in order to conserve this ideal and economic fuel for domestic and other less wasteful industrial purposes, for which, owing to its nature, it is especially useful.

Reckless Waste in Canada.

We, in Canada, need not at present consider the above refinements in the use of natural gas. Such a course, particularly in Western Canada, would seem like trying to stop a leak in the bung before "heading" the barrel.

Natural gas rights in the Provinces of Alberta, Saskatchewan, Manitoba and Northwest Territories are disposed of under Dominion laws. These laws make no provision for preventing the waste of natural gas, and the consequence is that considerable waste occurs. The importance of natural gas in Alberta may be realized when it is considered that a company is now piping it from Bow Island to Calgary, a distance of 175 miles. In addition to supplying Calgary, the company has branch lines to Leth-

bridge, MacLeod, Granum, Nanton, Claresholm, Brooks and Okotoks.

The province of Ontario has reduced the waste of natural gas to a minimum by causing all abandoned wells to be plugged and by levying a tax of two cents per thousand feet, with a rebate of 90 per cent. when the gas is used.

A NEW CRUDE OIL ENGINE.

A NEW oil engine has made its initial bow to the Canadian public, and, judging by its cheapness of operation, and its simplicity of action, it is an engine that has come to stay. It is the Bolinder Crude Oil Engine, made in two types, for land and marine work. The agents, the Canadian Boving Co., Ltd., Toronto, have one of each type on exhibition near their offices at 164 Bay Street.

The engine works on the two-cycle principle. There are no complicated devices about it, and anyone of ordinary intelligence can drive it. All the parts are manufactured with a perfect system of jigs and guages, thereby making every part interchangeable. The uses to which this engine can be applied are many.

Its main features are its simplicity and cheapness of operation. The 12 horse power engine on exhibition, when tested, consumed 1.02 gallons of crude oil per hour; the oil costing eight cents a gallon. An engine of this size would consume 1.5 gallons of gasoline, costing about 24 cents a gallon, thus, the expense of operation with the latter would be 32 cents an hour, compared with crude oil at 8 cents.

Close regulation is another feature. The engine can be adjusted to run at any required speed. Forced lubrication is used for the cylinder and bearings, the lubricating device being a Bolinder patent. It is primarily an engine for supplying cheap power in small quantities, and is handy in cases where only about 200 lamps are required.

INCREASING USE OF MOTOR TRUCKS.

THE use of motor trucks is extending much more rapidly than is generally appreciated, and in this connection, the following percentages of increases in various localities are interesting:

In Massachusetts, during one year, registrations increased 62½ per cent.; Washington, D.C., nearly 100 per cent.; Los Angeles, 1,700 per cent., and Chicago, 120 per cent. It is estimated that 50,000 trucks are in use in the United States at present, and, if the rate of increase is maintained, this number probably will be doubled during 1913. Although owners of smaller establishments are rapidly coming to use these power vehicles, special activity is noticeable among the larger concerns, such as express, contract delivery and transportation companies, foundries, machine shops, steel plants, storage warehouses, coal companies, etc. As an example, the Adams Express Co. is now operating 485 motor wagons in different cities, the American Express Co., 352, and together, the five leading express companies have 968 in service. Other large users are: New York Edison Co., 104; Western Electric Co., 63, and the Burns Bros. Coal Co., New York City, which is using twenty-one 10-ton coal trucks.

To keep pace with the demand, a larger number of sizes is now offered by the manufacturers, especially from 500 pounds to 5 tons capacity. Many new models, also, are being made in the 1,500-pound, 1-ton and 3,000-pound capacity machines, and these embody such features as self-starters, demountable and automatic dump bodies, left steer and center control, and spring-supported power equipment.

CANADA'S TRADE IN 1912.

CANADA'S total trade for the twelve months of the past year passed the billion-dollar mark by a little over five and a half million dollars. Final or detailed figures will not be available for some weeks yet, but the returns received so far by the Trade and Commerce and Customs Departments show that the billion-dollar mark has been well passed.

As compared with the Dominion's trade for 1911, this represents a gain of nearly $189,000,000, or 23 per cent. Imports for the past twelve months totalled approximately $654,000,000, while exports amounted to nearly $352,000,000. The gain in imports was nearly $140,000,000, while exports increased by nearly $49,000,000. Only one country in the world rivals Canada in the percentage of trade growth during the past year, namely, Argentina, and by the end of the fiscal year it is expected that Canada will have reached tenth place among the countries of the world in respect of total trade. The Dominion's trade has doubled within the past six years and trebled within the past thirteen years.

The principal gains in exports during the past year have been those of agriculture, mines and manufactures. The increase in exports of agriculture has been over twenty-five millions; in mines, over twelve millions; and in manufactures over seven millions. Exports of the forest and of animals and their products have fallen off several millions, due, doubtless to the increased demands of the home market.

TORONTO FIRM EXTENDS.

FIVE years ago, the premises of the Toronto Testing Laboratory, Ltd., were ideal for their laboratory work. In that time the business has grown to such an extent that more commodious premises became necessary. These have been found at 160 Bay Street, Toronto, where the firm will be able to maintain the high standard of their service, and to keep abreast with the wonderful development in the metallurgical field.

FACTORY FIRES.

THE Committee on Safety of the City of New York has issued the following safety code for factories and warerooms:

1.—Forbid smoking in the warerooms.

2.—Blow out matches before throwing them away.

3.—Clear out rubbish and clippings every day from work-rooms, hallways and basements. Metal cans or metal-lined boxes are required by law to hold such rubbish during working hours.

4.—Do not keep benzine, naptha, gasoline, alcohol, turpentine, paint or varnish, except in safety cans, as required by law.

5.—Get a license from the fire department before storing these inflammable fluids on your premises.

6.—Keep gas jets guarded by wire cage, so that materials may not touch the flame.

7.—Keep motors and gas engines boxed and enclosed in fireproof partitions.

COMMERCIAL MOTOR VEHICLES.

MOTOR vehicles for industrial, commercial, municipal and federal purposes are now used by more than 250 distinct lines of business. More than 4,000 are registered in New York City and more than 2,000 in Chicago. The total average cost of operation and maintenance for a one-ton gasoline truck is $8.50 per day, and for a ten-ton truck $18.50 per day. The average for electric vehicles is about one-third less, but their mileage is proportionately less. The actual cost per mile of hauling with horses in a city is from 14 to 18 cents, with a double team, and from 20 to 35 cents, with a single horse. The cost per mile with motor trucks is from 7 cents for a five-ton truck to 11 1-3 cents for a one-ton truck. In department store work, with electric vehicles, the cost of delivery varies from about 4 cents to 10 cents per package.

ELECTRICITY AND HYDRAULICS

This department is intended, in addition to individual treatment, to feature the close relationship existing between electricity and hydraulics in the power and light field.

CANADA'S NORTHERN WATER POWERS.

By L. G. D.

VERY little is yet known of the value of the natural resources of Canada's far Northwest. Explorers have, from time to time, described, in general terms, the great rivers, such as the Mackenzie, the Athabaska, the Slave and the Peace. In still more general terms, the forests and mineral resources, and even the agricultural possibilities, have been described.

During the past two summers, the Commission of Conservation has had its Hydro-Electric engineer at work gauging streams and examining possible waterpower sites in this region. Two of the rapids thus examined are described herewith:

Fort Smith Rapids.

The Cassette, Mountain, Pelican and Drowned Rapids, collectively known as the Fort Smith Rapids, are situated on the Slave River and extend from Smith Landing to Fort Smith, a distance of some 16 miles. The various rapids, whose descents, taken separately, vary from 10 feet to 38 feet, may be considered as a continuous rapid from head to foot, broken by short intervals of swift water, giving a total descent, in the 16 miles, of some 135 feet. It would probably be difficult to group all these rapids into one development, although it would be very desirable to do so from the standpoint of conservation, but numerous islands and projecting points from the mainland afford natural conditions for easy development.

The volume of water in these rapids is enormous, being the combined flow of the Peace and Athabaska and their tributaries, with one of the great northern lakes, Lake Athabaska, acting as a reservoir to regulate the flow. The total power available during the season of navigation (May to November), by utilizing the total head of 135 feet, is estimated at 1,000,000 h.p., and is divided among the different rapids in proportion to the head in each. Raw material for pulp and lumber industries is found all along the river and at the rapids.

Peace River Canyon.

The Peace River canyon has long been renowned for the wild character of its waters, and no white man or Indian, be he ever so experienced in river work or egged on by foolhardiness, ever attempts to run its rapids. Rafts or boats which, by carelessness or otherwise, are allowed to drift past its upper gates are never seen again, being engulfed by some of its many powerful whirlpools. It is little wonder that the velocity of its waters should be so great when one considers, as has recently been ascertained, that the descent from head to foot is some 225 feet in a distance of less than 18 miles. This immediately suggests its possibilities as a waterpower development.

The total minimum power available during the open-water season (May to November) is estimated at 400,000 h.p. This is based on the assumption that the total head of 225 feet can be utilized. Its development for waterpower purposes will involve rather intricate problems, but to compensate for this, one must consider its situation near the raw material for pulp and lumber industries. It is also at the head of navigation of the Peace River and lying adjacent to it are immense coal fields, a large portion of which have already been staked out.

ELECTRIC SPARKS.

AN electric heater has recently been devised for shrinking on wheel rims. It consists of a built-up iron ring, with grooves containing a heating coil traversed by an alternating current, and adapted to be laid in contact with the rim to be shrunk on. The heating is rapid, and it is found that the expansion of the rim continues after the current is switched off in the heater, allowing time for the wheel body to be got ready for insertion in the rim. As compared with a gas fire, two or three times as many rims can, it is said, be shrunk on in a given time by this appliance.

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A plant for electrically sterilising water by means of electrically-produced ozone has been erected at a station of the Baltimore County Water and Electric Co. in Maryland. It has been found, says Electrical Engineering, that the area required is only one-tenth that required for rapid sand filtration. The ozone generator is 33 in. high by 33 in. diameter. A large number of aluminium tubes are used for the production of the electric discharge. Each unit can deal with one million gallons per twenty-four hours, and requires five kilowatts i.e., about 18 watts per square foot of electrode surface.

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This year's annual report of the Secretary of the United States Navy states that everything points to the increased use of electricity as a motive power for the engine-room of the future. With regard to radio-telegraphy, the report says that since the introduction of high frequency quenched-gap radio-apparatus the most urgent work of the department has been the modernising of old installations. The Navy Department is maintaining forty-one shore stations and six stations on light vessels. A new station is being erected on the island of Unalga. The chain of Alaskan coast stations is, in conjunction with the inland army stations, of great importance commercially as an alternative means of communication in case of breakdown of the cable or of the land telegraph lines.

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In a paper entitled "Notes on the Installation of Colliery Electrical Plant," Mr. F. E. Harris points out that on a system where the neutral is earthed, a fault on one main rapidly increases until it trips the circuit breaker, or if a high resistance fault burns itself out, it usually results in a breakdown at the point of fault only. This, together with the fact that the potential to earth is restricted to a known figure, commends to many engineers, the earthing of the neutral. It must be borne in mind, however, that by earthing the neutral, an increased stress is put on the system at certain points—that is, between all live parts of apparatus, such as motor windings, switch blades and contacts, and the earthed motor cases, armature cores, switch boxes, and fuse boxes. As surface leakage will thus be set up more readily, ample clearance must be allow-

ed. A high-resistance fault set up between a live contact of an air-break switch or fuse and the earthed case might prove dangerous.

ELECTRIC DRIVE IN WEAVING SHEDS.

IN a paper read before the Manchester Institution of Electrical Engineers, Mr. S. N. Whitehead claimed that the individual electric drive in weaving sheds allowed of the selection of exactly the right power unit for every machine to be driven. In the belt-driven shed, with a group of looms running off the same shaft, should some looms be shut off the speed of the others would be increased, and conversely, so that the productive power of the looms would be continually altering.

It was of vital importance that the turning movement of the mechanism driving the loom should be absolutely steady and free from any impulses or shocks. Experience proved that a tremendous saving was affected by using the polyphase high efficiency loom motor. The most suitable scheme for a weaving shed was a three-phase 50 or 40 period, 200 to 230 volt system. In securing current there were advantages in purchasing from some public supply company. Less initial capital expenditure would be entailed and greater economy of space effected and the periodicity of supply would be much steadier. In an electrically-driven shed, there were losses in transmission, but only to the extent of 2 or 3 per cent. of the shed output, and they remained constant, whereas the friction losses of a belt-driven shed increased as the premises grew older.

CANADIAN GENERAL ELECTRIC COMPANY.

AT a meeting of the directors of the Canadian General Electric Co., held recently, Mr. W. R. Brock was elected honary president and chairman of the board, and Mr. Frederic Nicholls was elected president of the company to fill the vacancy created by Mr. Brock's election to the honorary presidency.

Nearly twenty-five years ago, Mr. Frederick Nicholls formed a syndicate of ten members, who each subscribed $1,000, or a total of $10,000, with which to start in the electrical business. This syndicate capital of $10,000 has grown steadily year by year until now the assets of the company amount to nearly $20,000,000, while employment is given to about 5,000 people.

When, after the expiration of a few months, the original syndicate started to extend its activities, two of the original ten members retired, leaving the following eight members: — Messrs. W. R. Brock, H. P. Dwight, Frederic Nicholls, W. D. Matthews, Hon. J. K. Kerr, Hon. Geo. A. Cox, Hon. Robert Jaffray and Hugh Ryan. With the exception of Mr. Hugh Ryan, who remained a director during his lifetime, and Mr. Dwight whose death occurred this year, there has been no break in the original association of syndicate members, although the number of directors was increased a few years since.

For twenty-five years, until this year, no change has occurred in the Executive of the company, Mr. Brock being president and Mr. Dwight and Mr. Nicholls vice-presidents, respectively.

ELECTRICAL SYSTEMS AT COLLIERIES.

THE electrical systems mostly in use at collieries are the direct-current and the three-phase medium-pressure system, 500 volts being a common pressure. Many breakdowns have occurred in the past owing to engineers treating this pressure the same way as they had hitherto treated 100 and 220 volts. The network of mains should be arranged so that it can readily be split up for testing purposes. A drop in the insulation of any section can then be at once localised and remedied.

One advantage the alternating-current system possesses over the direct-current is that the system network can be permanently split up into sections by means of static transformers. A fault on one section does not in this case affect the whole network, but only that portion which is in electrical connection with the secondary winding of a particular transformer. Apparatus working under very bad conditions can thereby be isolated from the rest of the network, and can also be supplied at a lower pressure if desired. Small motors driving acid pumps, tar pumps, boiler-tube cleaners, lighting down the pit, lighting under draining hoppers, and portable lamps used for cleaning boilers and stills, can be more safely supplied with power in this way. By means of the transformers, the pressure can also be raised when power has to be transmitted for a considerable distance.

MILKING BY ELECTRICITY.

ERNEST Gunn, who has 100 cows on his farm near Beaverton, Ont., and milks 75 by means of electricity, will build another stable to accommodate another 100 head in anticipation of Hydro-electric power. Mr. Gunn is taking an active part in the Hydro forward movement in Ontario County, particularly in the districts of Beaverton, Cannington, Woodville and Sunderland.

ONLY APPARENTLY DEAD AT FIRST.

DO electric shocks kill immediately? The Practical Engineer (London, Eng.), in its November issues says No, and adds: "The Montreal Daily Witness is surprised that a young man named Murray McQueen survived an electric shock of 2500 volts, because only 2000 is used in the death chamber of Sing Sing. It is stated that only for the infinitesimal fraction of a second the current passed through his body. The circuit was broken as he fell from a ladder to the concrete floor, a distance of 15 feet. He was carried away in a death-like trance. His right arm turned quite black from the shoulder to the wrist, while just below the knee, where the current emerged,was a round hole as large as a 25 cent piece. Ten days later he was able to leave his bed. As a matter of scientific fact, there is nothing remarkable in the incident if the truth were told."

In a letter to the Lancet Dr. E. R. Morton, President of the Section of Electro-Therapeutics of the Royal Society of Medicine, asserts that in the case of electric shock, death is only an apparent death at first, and that whatever the conditions and severity of the accident, there is practically always a time, varying from a few minutes upwards, during which it is possible to resuscitate the victim by artificial respiration if resorted to at once. Voltage, he asserts, is one of many factors that determine the effect of a shock, and practically every case can be revived; most will make a complete recovery if first aid be promptly forthcoming and properly applied.

ELECTROCUTING CATS AND DOGS.

INSTALLED in the home of the Toronto Humane Society, at 197 McCaul street, when completed, will be an electric cage used for the destruction of cats and dogs. The cage is large enough to receive any dog up to the largest mastiff or St. Bernard. The inner cage contains a metal pan. From metal bars on each side of the inner cage depend strong spiral springs with hooks at the lower ends. One of these bars is connected through one of its metal supports with the secondary electrical current. The primary circuit is made or broken by the closing and opening of the door. The instant the door is shut the animal gets the full force of the current.

REFRIGERATION DEPARTMENT

MECHANICAL REFRIGERATION. I.*

By William M. McRobert.**

AS the process of refrigeration is merely a transfer of heat from the space or goods to be cooled, to some convenient medium, we must look at some of the properties of heat, before taking up the details of refrigerating apparatus.

Heat.

Heat is as much an attribute of matter as weight, form, or size. Everything contains a certain amount of heat, which we will call, for convenience, its temperature. The amount of heat contained in any body is controlled by surrounding conditions. Heat, like water, always flows down hill. If two bodies of different temperatures are placed together, the heat of the warmer will pass into the colder until both bodies are of the same temperature.

The first problem to be solved was to find some agent of sufficiently low temperature to start the heat on its downhill course. In the early days of cold storage this was accomplished by natural ice, and acted sufficient for all conditions above the melting temperature of ice, but as the business of cold storage increased, and applied refrigeration expanded, the comparatively high temperature of ice refrigeration, and the moisture contained in the air by the actual melting of the ice, became objectionable. In looking for some means of transferring heat to a very low temperature, scientists turned their attention to "latent heat," and these two words are the whole sum and substance of mechanical refrigeration. The latent heat of ice is 142 British Thermal Units, that is to say, one pound of ice at 32 deg. F. will require 142 B.T.U. to melt it into water at 32 deg. F., or 142 B.T.U. must be extracted from water at 32 deg. F. to freeze it into ice at 32 deg.

Refrigerating plants are always rated in tons capacity, that is, a given number of tons refrigeration per day of twenty-four hours. Before the advent of mechanical refrigeration, it was natural to rate a machine in tons of ice melting capacity; therefore, if a machine is of ten tons capacity, that implies that it will produce as much refrigeration as the melting of ten tons of ice. In order to ascertain the quantity of refrigeration to be obtained from one ton of ice, we must refer to its latent heat. We found it required 142 units of heat to melt one pound of ice at 32 deg. to water of equal temperature, therefore, one ton refrigeration=142 B.T.U.×2,000 pounds, or 284,000 B.T.U.

Operation of a Refrigerating Machine.

Apparatus designed for a refrigerating unit is based upon the following series of operations:

Compress a gas or vapour by some external force, then relieve it of its heat so as to diminish its volume. Next cause this compressed gas or vapour to expand, so as to produce mechanical work, then lower its temperature. The absorption of heat at this stage by the gas in assuming its original condition, constitutes the refrigerating effect of the apparatus. A refrigerating machine is a heat engine reversed. The efficiency depends upon the range of temperature. Unlike the heat engine the refrigerating machine has the greatest efficiency when the range of temperature is small and when the final temperature is raised.

If the temperatures are the same, there is no theoretical advantage in employing a gas rather than a vapour to produce cold. Air offers the double advantage, that, it is to be obtained everywhere, and we can change the higher pressures at will, independent of the temperature of the refrigerant; but to produce a given useful effect, the apparatus must be of large dimensions. The difference between a steam engine and a refrigerating machine is, that a steam engine receives heat from the boiler, converts a part of it into mechanical work in the cylinder, and throws away the difference to the condenser, or other suitable place. The ammonia in a compression refrigerating machine receives heat from the brine tank, or cold rooms, an additional amount of heat from the mechanical work done in the compression cylinder, and discharges the sum into the condenser. The efficiency of the steam engine=work done+heat received from the boiler; the efficiency of the refrigerating machine=heat received from the brine tank or refrigerating chamber+heat required to produce the work in the compression cylinder. The most common agents employed in the process of mechanical refrigeration are ammonia, carbonic acid, and air.

Direct Expansion System of Ammonia Refrigeration.

In the direct expansion system of ammonia refrigeration, there are only four parts to be considered and remembered.

First.—The evaporating or expansion side of the plant, that is the cold storage rooms, where the ammonia is expanded from a liquid to a gas.

Second.—The ammonia machine or compressor, where the cold gas is drawn from the expansion coils and compressed to a pressure sufficiently high to enable it to be liquified again at the temperature of the condensing water.

Third.—The ammonia condenser, or liquefier where the hot dense gas from the compressor is cooled and returned to its liquid state.

Fourth.—The liquid receiver where the ammonia is stored ready for distribution to the coils in the various cold storage rooms.

In order that we may understand the principle of ammonia refrigeration more clearly we can imagine an outline sketch of same. (A)—Represents the expansion coils, or cold storage rooms. (B)—The compressor, which pumps the expanded ammonia from the coils in the rooms, and discharges same to the condenser. (C)—The condenser, which condenses the ammonia from a gas to a liquid. (D)—The liquid receiver, which receives the liquified ammonia from the condenser.

Ammonia is one of the best known extractors of heat, and the expanded ammonia gas passing through the coils in the various cooling chambers absorbs the heat from its surroundings and holds the rooms at any desired temperature. Ammonia will boil in open air at a temperature of 28 deg. below zero. The quicker the expansion, the lower will be the resulting temperature. Each set of expansion coils is provided with a valve to regulate the quantity of ammonia desired to be fed to the coils.

We can divide the refrigerating plant into two parts. one high pressure and the other low. The condenser and liquid receiver being the high pressure side, and the expansion coils the lower pressure.

*From a paper read at a recent meeting of the Central Railway Club, Toronto.

**Chief Engineer, Gunn's, Ltd., Toronto.

The low pressure side of the system is really where the actual performance of refrigeration is done. If we could find any evaporative fluid cheap enough that waste was of no object, and let it flow through the coils to the open air, the whole process of refrigeration would be completed. Ammonia really absorbs heat just as a sponge absorbs water, and before it can be made to do work over and over again, the heat must really be squeezed out of it, just the same as water is squeezed out of a sponge. This is accomplished by subjecting it to a high pressure in an ammonia compressor, which discharges it into a condenser, where the heat is squeezed out.

Dangers of Ammonia.

Although most people are well aware of the damage and trouble which exist from steam joints blowing out, or any serious leakage of steam, probably all are not acquainted with what might happen if an ammonia joint blows out. In the case of steam, the only danger is in getting scalded, which in itself is enough, but in the case of ammonia the danger is two-fold, as in addition to scalding there is always a possibility of suffocation. I know of a case in my experience which occurred on a ship in mid ocean, where a cylinder burst on the ammonia compressor, and the fumes would have suffocated everyone on the ship, but for the presence of mind of the officer on watch, who turned the ship to the wind and allowed the ammonia to escape in another direction. Happily ammonia explosions do not often occur. Even the slightest leak of ammonia in an engine room makes its presence very severely felt.

The Piston Rod Stuffing Box.

Probably no part of the ammonia compressor has received so much attention as the piston rod stuffing box. The piston rod of a double acting compressor has to withstand a high and low temperature alternately, the cold gas from the expansion coils and hot gas after compression. The stuffing box of an ammonia compressor is often as much as twelve inches deep. This is really divided into a double compartment, there being about four or five turns of packing in the bottom of the box, then an oil sieve or lantern as it is named, then other four or five turns of packing next the gland. The object of this lantern (which is connected to the suction side of the machine) is to collect any ammonia gas which has passed the first turns of packing; it also acts as an oil reservoir. A great deal of trouble is experienced with ammonia piston rods leaking, and for some reason the rod becomes very easily scored after which it is almost impossible to prevent leakage.

There are a large number of different makes of ammonia packing on the market, many sold at a price much in excess of their actual value. Every engineer has his own particular idea as to what is best, but of course conditions vary in almost every instance. I know of a case in mind where a company put a set of a metallic packing into an ammonia compressor on a thirty days' guarantee, and before the end of that time the rod had commenced to score slightly and before another month had passed the piston rod was so badly cut that it had to be taken out and turned down. The packing itself was completely perished, and showed to have been of cheap construction, being simply a piece of cotton rope with a filament of babbit or some similar metal cast around it.

The Ammonia Condenser.

For a number of years the ammonia condenser was the subject of many experiments, but the various types have been narrowed down to two, the atmospheric and double pipe condensers. We will take the atmosphere condenser as the first example. These are divided into two classes, namely, top and bottom supply, but the former is most widely used. The condenser is divided into a series of elements or stands all directly connected with the discharge pipe from the compressor by means of a header, each element or stand being controlled by a valve of its own so that it can be cut out from the others as required. About twelve sets of stands usually constitute the average size condenser. The method of operation is that the hot dense gas from the compressor enters at the top of the condenser, which is simply a series of pipes connected together to comprise one large unit, and comes in contact with the cooling water which flows over the condenser and causes the ammonia to be liquefied, after which it passess into the liquid receiver to be stored, ready to be fed to the expansion side of the plant as required. This type of condenser renders it necessary to keep the ammonia at a very high temperature. In some top supply condensers, an auxiliary condenser is employed. The hot gas from the compressor first passes through this, and is partly cooled with the water which has already performed its duty in the main condenser. After passing through the auxiliary condenser, the gas is delivered to the top of the main condenser and meets with the original supply of cold water. This arrangement has been found to give about 25 per cent. more efficiency over the single condenser.

The Double Pipe Condenser.

This type of condenser is formed with two sets of pipes, one inside of the other. The general rule is to use 1¼ inch pipe for the inside and 2 inch for the outside, the former being the water supply and the latter the ammonia, the water and the ammonia passing in opposite directions. In the vertical condenser of this arrangement the ammonia gas enters at the top and flows down through the annular space between the two pipes, flowing to the receiver tank at the bottom in a liquid state ready to be expanded in the system. The water, of course, will enter at the bottom, and discharge at the top. This in some respects is a superior arrangement to the atmospheric condenser on account of the ammonia gas coming into such intimate contact with the condensing water. Under summer conditions when the temperature is high, the double pipe condenser will operate with about 40 per cent. less water than the atmospheric type. The double pipe condenser is usually placed in the enine room near the compressor, thus making the discharge pipe very short, and reducing the friction of the gas passing to the condenser.

PERILS OF COLD-STORAGE.

THE Toronto "Globe" has been looking ahead at the future of cold-storage, and is pessimistic. In its issue of January 9, it has the following editorial on the subject:

"This modern invention is an addition to the list of society's disappointments. Many thought it was going to save the farmer from the loss and waste of occasional superabundance, and save the consumer from the shortages of seasons of scarcity. Its tendency is to deprive the farmer of the occasional advantages of scarcity and the consumers of the occasional advantages of superabundance. Operated for private gain, its tendency is to subject the consumer to the continuous high prices of scarcity and the farmer to the continuous low prices of adundance. From a channel between producer and consumer it tends to become a costly obstruction, controlling both the price paid the producer and demanded from the consumer.

"The important economic possibilities of cold storage may necessitate some form of Governmental intervention if relief from the needless tariff obstruction does not prove sufficiently effective in averting abuses. There is no capacity for constructive legislation at Ottawa or Toronto, but it will not be always so. The attaching of date labels and the fixing of limits to the period of cold-storage for various products might have a beneficial effect. It may be necessary for the Dominion, Provincial, or municipal authorities to provide the requisite service, available for private customers at reasonable rates. Economic blunders may rob the public of the benefits of the greatest mechanical inventions and chemical discoveries. We must not allow the possibilities of cold-storage to be lost by mismanagement."

THE READERS' POINT OF VIEW

Devoted to brief descriptive article contributions covering ideas and experiences pertaining to power plant practice and operation. We pay for accepted material.

DIFFICULTY IN STARTING A GAS ENGINE.

By Harry Westwood.

SOME time ago I had charge of a plant in which were two suction producer gas engines. One was a two-cylinder vertical 16 inch. bore engine, running 250 revolutions per minute, and the other, a single cylinder horizontal 14 inch bore engine running 180 revolutions per minute. The latter ran morning and afternoon for about two hours at a time when the load was heavy. The two engines ran off the one producer thus:—

When I went to start the small engine, the larger one took all the gas, owing to its running faster, its size and its being situated nearest to the producer. As soon as I gave the small engine a few shots of air to get it in motion and opened the gas valve, the air would rush in, due to the heavy suction of the other, and draw the gas away. I tried getting it in motion with compressed air and have some one put in the friction clutch on the line shaft to pull it up to speed. I next opened the gas valve. The engine sucked the gas until it came to the cylinder, and would start to take its explosions, thereafter settling down to work in parallel with the other. It should be understood that the small engine was driving on a line shaft on the other side of the yard from the large engine, although the two shafts were connected by a long belt at about 75 feet centres.

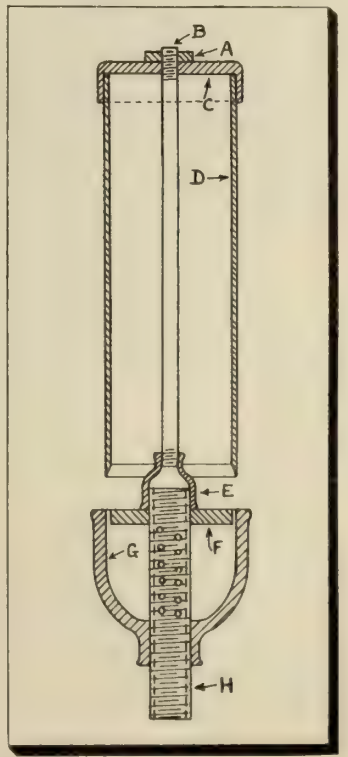
The foregoing, however, proved to be an inefficient method of starting, as it not only pulled down the speed of the shaft, but burnt the hardwood blocks in the friction clutch and caused no end of trouble. After trying different schemes, I finally succeeded in making a successful device, which may help someone else under like conditions.

There was a 1¼ inch nipple and valve in the gas pipe just above the main stop valve, which was used as a purge pipe. Into this valve I screwed a 1¼ inch nipple, and on the latter fixed a 1¼ in. tee, with a bushing 1¼ inch by ⅜ inch on one end and a 1¼ inch nipple on the other. I then screwed a ⅜ inch pipe into the former, so that the end of it passed the centre by about two inches, and connected the ⅜ inch pipe to the air receiver or tank. By opening the 1¼ inch valve on the gas pipe and turning on the air, which acted as a syphon, the gas was drawn to the engine. A few shots of air at 150 lbs. pressure got the engine in motion, and with the opening of the gas valve to the cylinder, it never failed to start. The air is shut off and the purge valve closed when the engine gets fairly started.

A CHEAPLY MADE FACTORY WHISTLE.

By J. E. N.

HEREWITH is shown a home made steam whistle that is in regular use. When blown it can be heard for many miles. Referring to the sketch, (A) is



HOME MADE FACTORY WHISTLE.

a locknut, (B) a solid rod, (C) a 9-inch cap, (D) a piece of 9-inch W.I. pipe, 30 inches long. (E) is a 2½x1-inch reducing coupling, and (F) is a solid flange. (G) is a 9x2½-inch reducing coupling and (H) is a piece of 2½-inch pipe screwed throughout its length and drilled with a number of holes, as shown, for the passage of the steam.

A factory-made whistle will cost at least three times as much as this one can be made for, and its sound will be no better.

WHY HE CALLED THE ENGINE "SHE."

By J. S.

A VISITOR walked into an engine room one day and began asking the engineer questions.

"How's your engine running?"

"Oh! she's doing fine," said the engineer.

"Why do you call the engine "she?", asked the visitor.

Now, the engineer was not asleep, even though he had been on duty sixteen hours!

"Well," he replied, "the reason I call my engine "she" is because it takes a Man to manage her. She is an old crank, but never gets hot. There is her bed and she lies on it.

Here you see her Head; this is her chest and there are her Wrist and Slippers."

The Visitor then thought he would get one in on the engineer, and said:

"And is she married?"

"Sure thing," replied the engineer. "There is one of her rings, and over there you can see the License. Here is the Governor."

F. Nagle writes from Fort William as follows:—I thought it was about time to write and let you know that Branch 29, C.A.S.E. is still alive and flourishing, with a rapidly increasing membership. Our last meeting was well attended, and we took our first educational lesson that night and greatly enjoyed it. The subject was "The Lubricator," and was very ably handled by our President, Bro. J. Insley. A diagram was drawn and, together with most of the subject

matter of the paper, was taken from the pages of The Power House. The lesson was interspersed with various practical hints from a number of the Brethren present and proved very instructive. As yet we have not received anything from the Executive along this line, but expect to do so soon.

The subject for our first meeting in January is to be "The Injector." This will be taken by Bro. Loosemore, to whom we are indebted for our blackboard. Bro. Ivey has provided us with a very neat Question Box, for both of which gifts the lodge as a body is very grateful.

—⚙—

THE "STUMPF" UNAFLOW STEAM ENGINE.

THE essential difference between the Unaflow and the ordinary compound or triple expansion engine is, that it accomplishes in its one cylinder, all that the others do in two or three cylinders. This is effected by making the steam flow in the same way as it is made to flow in a steam turbine "where the steam goes in hot at one end and has its energy extracted as it passes axially, always in the same direction, to the cold exhaust." The aim is to keep the steam end hot and the exhaust end cold. For this purpose the design of the steam cylinder must be very different from that of an ordinary Corliss or drop valve cylinder.

The Stumpf Patent.

There are several designs of Unaflow cylinders, but it is proposed to describe Professor Stumpf's patent only. His cylinder is made up of a central barrel and a loose valve box at either end. The barrel is almost twice as long as an ordinary cylinder barrel, and has cast round the whole circumference, in the centre of its length, a hollow exhaust belt terminating in a pipe formation, which is bolted direct on the condenser. In the metal which divides this exhaust belt from the cylinder, holes are cast which vary from 2 to 4 inches in diameter, according to the size of the cylinder. Also, unless the steam has a fair degree of superheat, a jacket is cast round the circumference of the cylinder at the end, and extends for a distance from each end of the cylinder which depends on the temperature of the working steam. The barrel casting therefore is rather complex, and requires the greatest care in design, molding, and the metal used. This difficulty is accentuated by the fact that, when working, the ends of the cylinder are always hot while the centre is cold. Some trouble has resulted from one or other of these cases, but experience now enables manufacturers to produce castings which successfully withstand the high temperature range.

The cylinder ends are similar to the ends common on drop valve cylinders, except that there is only one valve chamber in each end instead of two. The space in each cylinder end not taken up by this valve chamber has an important use which will be described later on.

Valve Gear and Pistons.

Various types of valve gear are in use for operating the two steam valves which work in the above valve chambers. Professor Stumpf's patent consists of a double-beat valve, of a special type, working on two flat seatings, which provides steam tightness while allowing for the expansion caused by varying temperatures. The spindle carrying the valves passes through a stuffing box, and then opens out into a fork arrangement. Above this it passes into a spring box, and is connected to a small piston on which a spring presses. In the fork of this spindle a cam is attached with its working face towards the valve. Working through the fork, and carrying a roller which operates the cam, is a valve rod working parallel to the axis of the cylinder, and operated from an eccentric. This eccentric is under the control of a crank shaft governor, so that, as the speed varies, the roller engages with the cam sooner or later as the case may be, and adjusts the quantity of steam admitted to the cylinder.

The piston is a special feature of a Unaflow engine, being about three times the depth of an ordinary piston. It takes up in the cylinder barrel the distance between the cylinder end and the nearest edge of the exhaust openings. Two complete sets of piston rings are used, one at each end of the piston. Several ingenious arrangements have been devised to obtain lightness in such a deep piston, combined with the necessary strength.

Special care is taken in the machinery of this engine to polish all internal surfaces which come in contact with hot steam. Valve chamber liners, valves, the inside of the cylinder ends, the barrel and piston are all most carefully finished off so as to reduce radiation losses to a minimum.

Action of the Engine.

The action of the steam is as follows: Consider a horizontal engine and suppose the crank is on the back centre. The back valve is wide open and steam is admitted, moving the piston forward. Cut off takes places not later than one-tenth of the stroke, and expansion continues until the back rings of the piston begin to uncover the exhaust ports.This occurs at seventh-eighths of the stroke, and owing to the large area of the exhaust ports the steam quickly passes into the condenser. On the return stroke of the piston, and at one-eighth of this stroke, the back rings cover the exhaust post and compression begins. Owing to the very small clearance spaces, compression is carried almost up to initial pressure, thereby heating up the surfaces at the hot end of the cylinder to the temperature of the incoming steam.

With cut-off at such an early point, and with the high compression, the indicator diagram has the "thin" appearance of a gas engine diagram. The high compression and small clearance cause a slight difficulty in starting the engine. Before the vacuum is obtained, compression takes place from atmospheric pressure or slightly over. Extra clearance space must therefore, be provided to prevent excessive compression, and this is accomplished by opening small valves which allow the hollow space in the cylinder ends mentioned above to be in communication with the cylinder barrel. Immediately the vacuum is obtained, these valves are closed. They can be made automatic, so that in the event of the vacuum failing when the engine is on speed, the clearance will be quickly augmented.

Comparison Features.

From the above description it will be seen that the principal points of difference between this engine and the ordinary types are:—

1.—The work usually done in two or three cylinders is done in one.

2.—The steam, instead of entering the cylinder at one end and exhausting at the same end, passes out through the centre of the cylinder when its work is done.

3.—The time during which the low condenser temperature can act on the cylinder surface is one-eighth of each stroke, as against the full stroke. This arangement of course enormously reduces cylinder condensation.

4.—In an ordinary cylinder the maximum clearance spaces are round the exhaust valves. In the Unaflow these are done away with, consequently, clearance spaces are reduced to a minimum, amounting in large engines to only 2 per cent. of the working volume.

It is evident that these deviations from standard practice must result in thermal economy. Steam has not to be wasted in heating up any cold surfaces. In one interesting diagram Professor Stumpf shows how the actual temperature gradient of the cylinder walls corresponds almost exactly with the temperature gradient of the steam at the same point. Further, steam is not wasted in filling up spaces which are of no use.

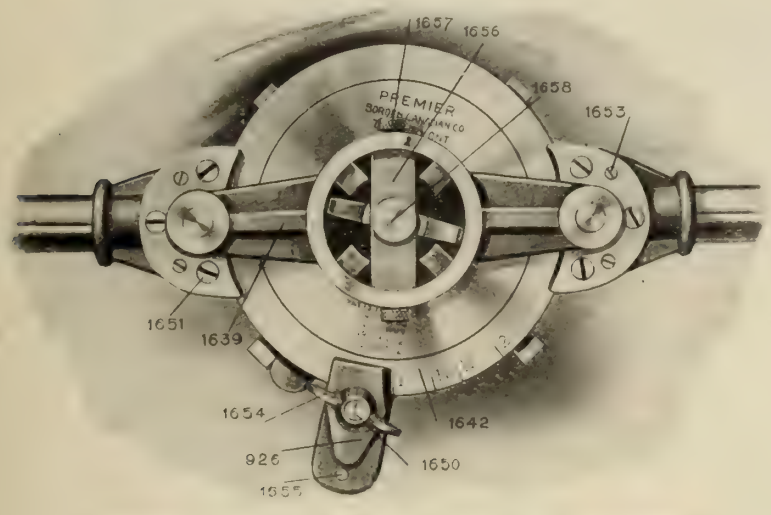
PROGRESS IN NEW EQUIPMENT

There is here provided in compact form a monthly compendium of the power plant manufacturers' achievements.

A NEW CANADIAN DIE STOCK.

THE Borden-Canadian Company, Toronto, report a gratifying increase of business during 1912, their shop having been taxed to its utmost capacity. The company have within the past six weeks put upon the market a new die stock of their own design, which is meeting with a very favorable reception. This has been named the "Premier," and is of the automatic release type; so that as soon as the dies have advanced sufficiently far on to the pipe to complete a standard (Briggs) length of thread, they release themselves from the work and advance on the pipe. The absence of a leader screw enables the die stock to be made much shorter than usual, so that it is possible to thread a nipple 5½ inches long without the use of a nipple holder.

The centering device is very simple. It consists of a scroll cam, without locks, which operates three jaws that guide the die stock on the pipe. No loose bushings are used. The stock, with one set of dies, will thread pipe 1 inch to 2 inches in diameter, either right or left hand thread This is accomplished by having the dies chased for R.H. thread at one end and



BORDEN-CANADIAN CO. NEW "PREMIER" DIE STOCK.

the tool is removed without the necessity of running it back over the threads. Much valuable time is thus saved and all risk of damage to the dies or thread is entirely avoided.

Another feature of the Premier die stock is the absence of the usual leader screw, the function of which is in this tool performed by the dies themselves. The latter are of a special patented form made in two steps. The first set of teeth start the thread and draw the die stock forward on the pipe, while the second set cut the full thread, the taper being obtained by the automatically expanding movement given the dies as they for L.H. thread at the other, and reversing them as required. By the use of one extra set of dies, the same stock will thread any pipe from ½ inch to 2 inches inclusive; while by the use of special dies, bolts, etc., may be threaded. This is one of the advantages of the absence of a leader screw, which would, of course, render impossible the threading of any screw differing in pitch from the leader.

The Premier die stock is well designed and strongly made. All parts are of steel, including the body, which is a steel casting. The use of this material enables a considerable amount of metal to be omitted around the circumference of the body, thus reducing weight and greatly facilitating the oiling of the dies. The automatic throw-off can be quickly removed when it is desired to cut straight and running lock nut threads.

A NEW REFRACTORY CEMENT.

UNTIL within the last few years, fire-clay has been most generally used for laying-up brick walls, cementing joints, patching and lining of furnaces, kilns, retorts, etc., where high temperatures are encountered. In spite of its exceedingly short term of usefulness, and the consequent necessity for repeatedly patching and repairing, founders and furnace men have until recently continued to use this material because there has been no substitute which could be generally used. Ofttimes the fire-clay was mixed with certain other materials to serve as "binders," which entailed considerable trouble and labor.

The H. W. Johns-Manville Co., New York, whose high temperature cements have become favorably known in recent years, have recently put on the market what they term "J-M High Temperature Cement No. 31" which it is said can be used practically whenever working temperatures range between 1,500 degs. and 3,100 degs. Fahr.

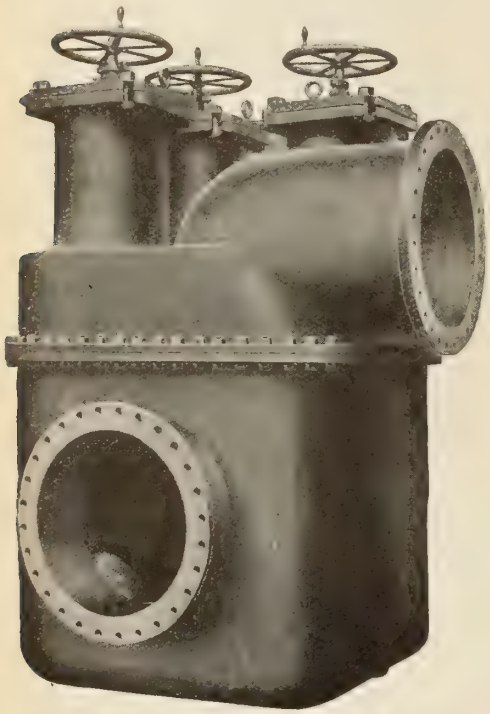
This new material is a dry powder mixture composed of asbestos and other materials of secret preparation. It is mixed with water to the proper consistency (say about 18 to 20 lbs. of water to 100 lbs. of powder), for working like mortar or tamping around molds.

When used for setting up fire-brick for boilers and furnaces, lining and roofing furnaces of various kinds, or molded into door jambs, lining fire doors, repairing side walls of furnaces, making stay nut caps, etc., it has considerable mechanical strength. When air-dried, it will withstand a crushing strain of 883.5 lbs. per square inch. It vitrifies at the comparatively low temperature of 1,418 degs. Fah., and has a high melting point (3,182 degs. Fahr.). Be-

ing semi-acid in character, it can be used with chrome bricks, silica bricks or fire-clay bricks. It is claimed that experiments conducted with this cement show that it can be successfully used in building doors of angle iron framework without backing, or for making one-piece linings for gas or oil burning crucible furnaces.

LARGE MULTIPLE ANGLE TYPE WATER STRAINER.

THE accompanying illustration describes one of two large multiple water strainers recently built by the Lagonda Manufacturing Co., of Springfield, Ohio, for removing fish, sticks, leaves, seaweed, ice, etc., from the water



LARGE MULTIPLE ANGLE TYPE WATER STRAINER.

supply to a power plant. This strainer is of unusual interest because it is not only of large size (30 inches), but because it is of the angle type, that is, the water passes out in a direction 90 degs. from the entrance. These two 30-inch strainers and a similar one of 36 inches, were especially designed to meet peculiar conditions, and are typical of the many different styles of strainers which the Lagonda Co. has built to meet unusual requirements in power plant design.

As will be noted from the illustration, the strainer contains three filtering baskets, each one of which has a free straining area equal to that of the pipe line. The low velocity in the strainer also permits of ample time for impurities to settle and eliminate wear caused by the errosive action of water moving at high velocity. A further point of interest is the fact that the entire strainer can be buried beneath the power plant floor, only the hand wheels and top of the bonnet projecting above. Any one of the individual straining baskets can be removed from the body of the strainer by merely turning one of the hand wheels. The removal of one basket does not interfere with the operation of the other two, in other words, the flow of water is never interrupted. When the basket to be cleaned has been elevated to the cleaning chamber, it is taken out in an upright position and carried to some convenient place and emptied. This is one of the distinctive features of this strainer.

The Lagonda Mfg. Company build strainers for use in lines from 2 inches to 48 inches diameter, and containing from two to six baskets.

NEW ELECTRIC LOCOMOTIVE.

A GERMAN contemporary gives a description of a new type of locomotive, built by Brown, Boveri and Co., for the Chemin de fer du Midi. The pulleys on the spindles of the two motors are connected together by means of a coupling rod, and are each similarly connected by coupling rods to a pulley disc, carried on the driving wheel. In this way a trinangular system of coupling rods is built up, and the method has been found to give good results in practice, besides reducing the weight and cost of the locomotive.

The author shows that if the two motors have the same torque there is no stress in the rod connecting them together; he therefore suggests that this rod might be omitted. The motors may therefore be connected to the driving wheel by two cranks, which form with one another an angle rather greater than a right angle. On the triangular system, the angle between the cranks is about 60 deg. The author's system has the further advantage that the precise adjustment of the positions of the various spindles is unnecessary. He claims advantages for his system over the "triangular" method, provided that the angle between the cranks is less than 120 deg.

INTERNATIONAL ENGINEERING WORKS, LTD.

THE International Engineering Works Ltd., announce the purchase of the properties and complete re-organization of the business formerly owned by the Robb Engineering Co., with increased capital and manufacturing facilities. The extensive engine and boiler works at Amherst, N.S., Canada, will continue to build the full line of Robb engines and boilers, so well known to power and industrial plant owners throughout the Dominion. The equipment at Amherst, combined with that at South Framingham, Mass., will be at the disposal of the International Engineering Works, Ltd., and every consideration will be given to the maintenance of the high reputation of the Robb products. The plant and stocks of raw and finished materials will be enlarged and increased to meet the growing requirements of the Canadian trade.

AUTO-SYNCHRONOUS MOTORS IN ONTARIO PARLIAMENT BUILDINGS.

INTEREST has been aroused in the auto-synchronous motor recently, through the purchase of two by the Ontario Government for the parliament buildings. These were two motor generator sets of 200 k.w. capacity each, for supplying power and light. Messrs. Kilmer, Pullen & Burnham, Ltd., Toronto, got the contract, which also included a seven panel switchboard and lighting and power circuits for the building. These machines are worked in connection with the Hydro-Electric system, the current being changed from alternating to direct.

Two auto-synchronous motors of the same make have been supplied by the same engineers to the city of Edmonton. These machines have a capacity of 850 h.p., and run at 2,200 volts, 3 phase, 60 cycle, 900 r.p.m., with direct current exciters, and are connected to two 10 million Imperial gallon centrifugal pumps, supplied by Messrs. Drysdale & Co., Glasgow, Scotland.

Synchronous Motor Disadvantages.

The use of the synchronous motor for industrial purposes is rapidly increasing, due chiefly to the necessity of improving the power factor on large alternating current systems where the load is made up to a great extent of induction motors of various sizes, a great many of which are usually underloaded. The ordinary synchronous motor, however, has several disadvantages. It is necessary to have some method of bringing the motor up to speed before it can be thrown on the line to carry its full load. This must be accomplished, either by a separate starting motor, or by a short circuited winding arranged around the periphery of the revolving field, the latter method being usually adopted in America. Both these methods, however, permit of the motor being started on a small percentage of the normal full load only. The synchronous motor has the further disadvantage, that it is subjected suddenly to a severe overload,

SIEMENS BROS. DYNAMO WORKS | SIEMENS BROS. & CO.

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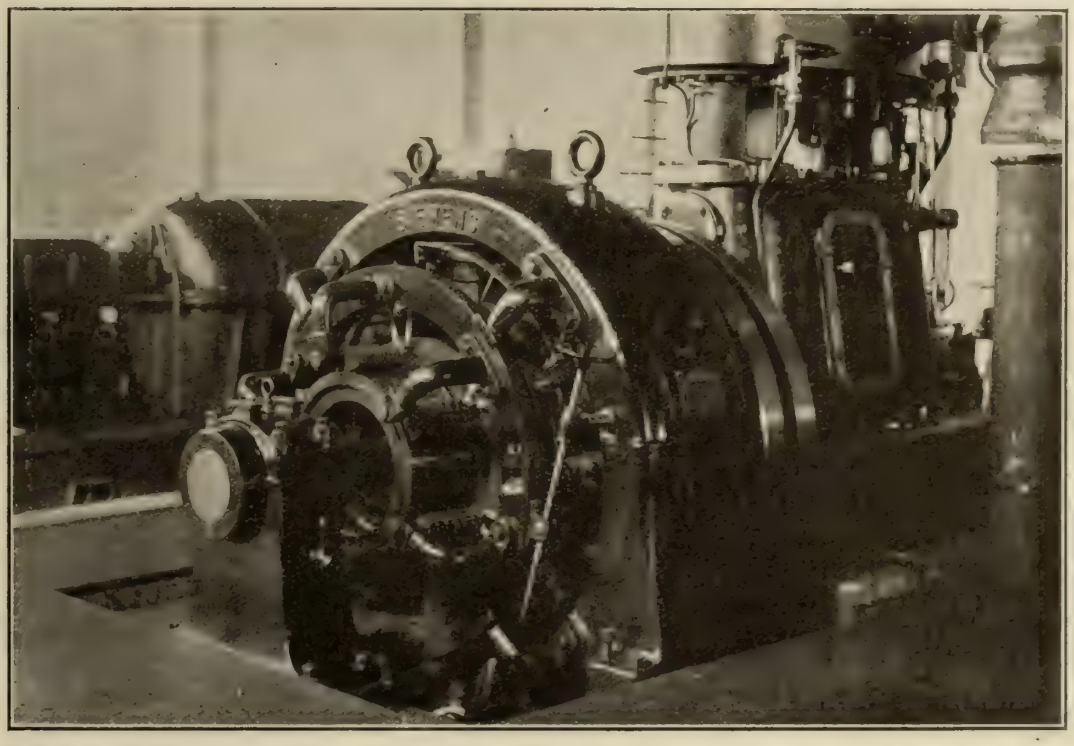


Siemens 400 K.W. 550-600 Volt Direct Current Street Railway Generator, Supplied and Installed for the City of Regina.

After the above set had been running a year we received a repeat order for a duplicate machine.

We have supplied or on order a large number of Direct Current Generators in Canada; amongst others we mention the following:—

1—800 K.W. Canadian Collieries,
1—700 K.W. Canadian Collieries,
1—800 K.W. Dominion Coal Co.,
1—750 K.W. City of Edmonton,
2—500 K.W. City of Port Arthur,
2—500 K.W. Nova Scotia Steel & Coal Co.,
2—500 K.W. City of Winnipeg,
2—400 K.W. City of Regina,
1—400 K.W. City of Lethbridge,
1—250 K.W. Canada Sugar Refining Co.,
1—220 K.W. Dominion Coal Co.,
1—200 K.W. City of Lethbridge,
1—150 K.W. Canada Sugar Refining Co.,
1—150 K.W. Winnipeg General Hospital.

Siemens Company of Canada, Limited

HEAD OFFICE:

Transportation Building - MONTREAL

BRANCH OFFICES:

STANDARD BANK BUILDING
TORONTO

McARTHUR BUILDING
WINNIPEG

or if the voltage suddenly drops, due to a disturbance on the line, the motor will drop out of phase and stop dead, and a delay of five or ten minutes will be caused until the motor is started up again. This in a great many cases causes serious inconvenience.

The Auto-Synchronous Motor.

The auto-synchronous motor was designed and patented some years ago by the Swedish General Electric Co., with the object of combining the advantages of the induction motor and those of the synchronous motor; and at the same time eliminating the drawbacks referred to above. The design of the machine is similar in every respect to that of the ordinary slip ring type induction motor, with the exception that a specially designed rotor winding is used, which is suitable for connection to a low voltage field current. A specially designed low voltage exciter is necessary on account of the low resistance of the rotor circuit. This machine is usually direct connected to the motor shaft, and often is series wound, as this construction eliminates the use of a field rheostat, the exciter voltage being varied by means of moving the brushes. The exciter voltage varies from 15 to 30 volts, depending on the design of the motors. Machines of this type are manufactured in all sizes up to 1,500 h.p. For larger outputs, on account of the heavy field current due to the low voltage for excitation, this type of motor has not been used.

Method of Operation.

The motor is started up as an ordinary slip ring type induction motor, that is, by closing the primary switch and gradually cutting out resistance, until, on the last contact of the starting resistance, the rotor will be short circuited, and the motor will be running as near synchronism as possible. In this way, the motor can be started up with as much as twice the full load torque. When the motor has obtained full speed, by means of a three pole double throw switch the starter is cut out of circuit, and direct current from the exciter is fed into the rotor; the motor will then drop into synchronism, and operate as an ordinary synchronous motor. The exciting current can now be adjusted to obtain any desired power factor correction, until the full capacity of the motor is being utilized.

Suppose that a heavy short circuit on the line causes a considerable drop in voltage, the motor will drop out of synchronism, but instead of stopping dead as the ordinary synchronous machine would, it will simply operate as an induction motor, the rotor circuit being short circuited through the exciter. When the line voltage returns to the normal condition, the motor will again drop into synchronism automatically.

Canadian Installations.

The following machines of this type are installed or being installed in this country:—

Corporation of Preston, Ont.—One 50 h.p., 2,200 volt, 3 phase, 25 cycle, 1,500 r.p.m. direct connected to centrifugal pumps.

Toronto Hydro Electric.—One 450 h.p., 550 volt, 3 phase, 25 cycle, 750 r.p.m.; one direct connected exciter, coupled to one 300 k.w., D. C. generator.

Corporation of Calgary.—One 1,500 h.p., 2,200 volt, 3 phase, 60 cycle, 400 r.p.m., with direct connected exciter coupled to 1,000 k.w., D. C. generator.

Ontario Pulp & Paper Co.—Two 150 h.p., 2,200 volt, 3 phase, 60 cycle, 720 r.p.m., with direct connected exciter for coupling to pulp grinders.

The above machines and others were ordered through Messrs. Kilmer, Pullen & Burnham, Ltd., sole dealers in Canada for The General Electric Manufacturing Co., of Sweden.

MORE CAPITAL FOR POWER CO.

THE Niagara Falls Power Co., which controls the Canadian Niagara Power Co., contemplates the issue of $3,000,000 of new stock. The officers and directors of the Canadian Niagara Power Company are:—President, William H. Beatty, Toronto; W. H. Brouse, President of the Toronto Stock Exchange; Hon. Wallace Nesbitt, K.C.; A. Munro Grier, K.C. of Toronto, vice-president and secretary; Delancey Rankine, and Philip P. Barton, general manager. The plants of the Canadian Niagara Power Company and the Niagara Falls Power Company are electrically interconnected, and each owns and operates electric power transmission lines.

It is understood the companies will instal new machinery and remodel their forebay, to prevent ice troubles.

AN ENGINEER'S CREED.

"I BELIEVE in the 'generation' of a demand for electricity, the 'transmission' of broad-gauge ideas, the distribution of electrical knowledge, the 'transforming' of opposition to friendship, the 'stepping down' from selfish narrowness, the 'stepping up' from individual differences; and that each man in himself should be a 'come-along of enthusiasm, so that the pull may be 'all together, all the time, for everything electrical.' "

Trade Gossip.

R. A. Ross, consulting engineer, of Montreal, has been engaged by the city of Calgary, Alta., at $100 per day and expenses to make a report on the local power and light situation.

Edward Armitage, a mechanical engineer at the Britannia Mines in British Columbia, was found shot on Monday, Dec. 23, fifteen miles north of Vancouver. He is alleged to have been murdered.

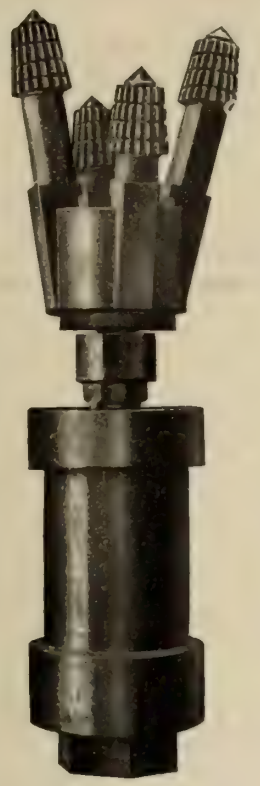
Mr. C. H. Cahan, K.C., left for England on January 10, in the interests of the Western Canada Power Co. It is expected that while in London he will conclude the pending contract with the British Columbia Electric Railway Co.

Mr. G. H. Tod, Engineer, Manning Chambers, Toronto, has contracted to supply one "Bennis" coking stoker and self-cleaning compressed air-furnace for a horizontal return tubular boiler at the Montmorenucy Cotton Mills, Montmorency Falls, Que. Mr. Tod is Canadian representative for this stoker, the makers being Edward Bennis & Co., Bolton, England.

Herbert Barber, manager of Hamilton power plant, has accepted the offer of the Toronto Hydro Power Department at a salary of $2,400. The Hamilton authorities offered to give him the same remuneration, but Mr. Barber decided that the opportunity in Toronto was the greater. On the occasion of his departure he was honored by his fellow employes, being presented with a costly smoker's outfit.

The Smart-Turner Machine Co., Hamilton, Ont., have recently secured the following orders:—Mr. Stephen Wellington, M.E., Madoc, Ont., Motor Driven Duplex Pump for Sinking Purposes; The Boston Insulated Wire & Cable Co., Hamilton, Ont., Duplex Pump; Standard Steel Construction Co., Welland, Ont., Duplex Power Pump; Mr. G. H. Tod, Toronto, Duplex Pump; Aylmer Condensed Milk Co., Aylmer, Ont., Simplex Vacuum Pump; The Coniagas Reduction Co., Thorold, Ont., Centrifugal Pump; The Pure Milk Co., Hamilton, Ont., Centrifugal Pump.

The International Engineering Works, Ltd., formerly the Robb Engineering Co., Ltd., report, through its Amherst works, sales of horizontal return tube boilers to Upper Fraser River Lumber Co., Standard Iron Co., H. Kelly & Co., Calgary; John Fenderson & Co., Sayabec; Town of Vegreville, Alta.; Eau Claire & Bow River Lumber Co., Calgary; Corporation of Kindersley, Alta.; Gorman Clancy & Grindley, Edmonton, and the complete power plant equipment for the Fort Garry Hotel, Winnipeg, which will consist primarily of Robb engines, boilers, air compressors, etc.



Cyclone for Air or Steam

We Rise to Remark

Some boiler tube cleaners take out all of the scale part of the time, and part of the scale all of the time. The LIBERTY CLEANER can always be relied upon to take out all the scale all the time. If you doubt this let us send you one on trial to prove it. Put it in competition with any other make of tube cleaner and subject it to the hardest kind of service. If it fails to do all we claim for it send it back at our expense.

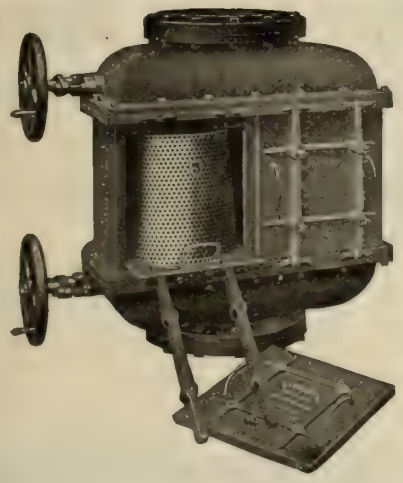
Try our LIBERTY CLEANER and see how thoroughly it will clean out the boiler tubes, and how effectively it will clean out the competing machines.

Write for catalog.

Liberty Mfg. Co.

6904 Susquehanna Street PITTSBURGH, PA.

Canadian Representatives:
Williams & Wilson, Ltd., Montreal. A. W. Williams Machinery Co., Toronto and Winnipeg.



Low Pressure Twin

Prepare for the Long Winter Season

Equip your water supply line with

TWIN STRAINERS

and eliminate that constant cleaning of pumps, condensers, etc. The TWIN STRAINER has two straining baskets, one of which is always free to be cleaned, without stopping or interfering with the continuous flow of the water. The Twin combination — TWO BASKETS, TWO VALVES —can't be beat for simplicity.

The cut on the right shows the debris kept out of a plant in six hours' time by one basket of the large sized Twin Strainer. This cut tells the story better than words can express it.

If you are having trouble with fish, leaves, sticks, etc., in your water, drop us a line and receive a copy of our Strainer Catalog. It's yours for a postal.

Elliott Company 6902 Susquehanna Street Pittsburgh, Pa.

POWER PLANT DEVELOPMENTS

A record of current municipal, manufacturing and general industrial projects, involving steam, gas, oil, electricity, air and water power equipment requirements.

BRITISH COLUMBIA.

Vancouver.—The Swift Canadian Co., Ltd, have had their meat coolers equipped with a 35-ton refrigerating plant furnished by the York Manufacturing Co., York, Pa.

Kamloops.—It is reported that the Swift Canadian Co., who recently completed a wholesale branch and cold storage house in Vancouver, will build a similar but smaller plant here.

Vancouver.—The British Canadian Securities Co. have let contracts for erection of a 4-storey cold storage warehouse at Richards and Pacific Streets.

Victoria.—The B. Wilson Co., Ltd., are enlarging their plant by installing a 57-ton vertical refrigerating machine, including 25-ton flooded freezing system and 25-ton distilling system, furnished by the Frick Co., Waynesboro, Pa.

Victoria.—The fire wardens may supplement the plant at the high pressure salt water system. At present there are two pumps, with a capacity of 2,500 gallons a minute each.

ALBERTA.

Calgary.—Calgary may go into the natural gas business on a stupendous scale to produce cheap power for manufacturing purposes. The Western Canada Natural Gas Company pipes gas from Bow Island, 200 miles away, and has the exclusive franchise in the city. The plan proposed by the city administration, which has been formulated by the power committee, is to form the 36 townships adjoining the city into a separate municipality, to buy the sister municipality for $10,000,000, construct a municipal trunk line to Bow Island gas fields and generate power in the adjacent municipality. Mayor Sinnott submitted an estimate of the cost of gas transmission, including operating expenses, interest and depreciation, at three cents per thousand feet. The plan meets the approval of the committee and will be submitted to the council at its next meeting.

Calgary.—R. A. Ross, formerly supervising engineer of Montreal, has been engaged by the city at $100 per day and expenses to make a report on the local power and light situation.

Calgary.—Owing to the interruption from time to time of the city's electricity supply from the hydro plant at Horseshoe Falls, it has become necessary to maintain an auxiliary steam plant of about 4,000 horse power. An addition will have to be made to the steam plant soon, as the consumption of power is increasing very rapidly. A Montreal engineer has been engaged to investigate the situation. The contract with the Calgary Power Co. expired Dec. 31. A new contract has not been made.

Calgary.—The promoters of the electric railway from Lacombe to Rimbey, a distance of 35 miles, have finished their work. Gas-electric motors will be used at first; later electricity from the Lacombe municipal power plant will be substituted.

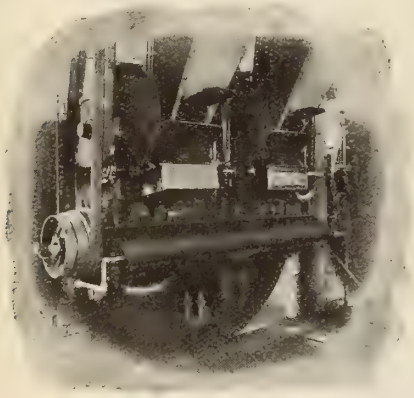
SASKATCHEWAN.

Saskatoon.—The Arctic Ice Co. have equipped their ice plant with new machinery furnished by the Gifford-Wood Co., Chicago. The machinery includes one incline elevator, one single chain gallery conveyor and ten gallery hoists.

Saskatoon.—The Trades and Labor Council have asked the City Council to re-open the department for the sale of electrical supplies.

MANITOBA.

Winnipeg.—Tenders for the supply of from 500 to 1,000 electric flat irons were recently called for by the City Light and Power Department.



The Stoker for Pulp and Paper Mills where cheap steam without smoke or grits is essential.

Bennis New Link Chain Grate Stokers
Bennis High Temperature Coking Stokers
AND
Patent Self-cleaning Compressed Air Furnaces
FOR
Water Tube and Horizontal Return Tube Boilers

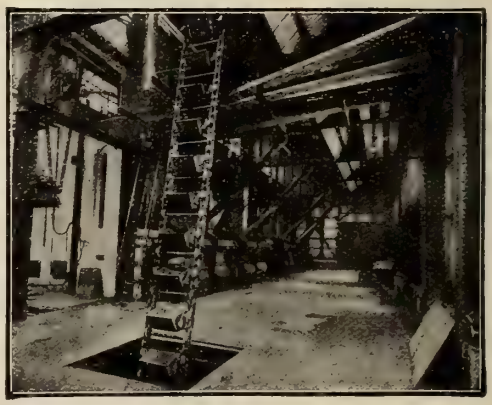
Bennis Machines are **saving** millions of dollars a year.
Bennis Machines are supplying over 3¼ millions of Horse Power.

Bennis Machines are hourly demonstrating in actual practice what CHEAP STEAM really means. They show what can be done with poor-grade, low-price fuels when efficiently burnt. They are designed and constructed to save boiler life; to keep down the coal bill; to abolish smoke, and to ensure maximum results from each pound of coal.

Bennis Stokers are constructed with the greatest care and fitted to meet individual conditions. They are SPECIALLY DESIGNED for the various types of boilers.

The coal is automatically carried from the store to the furnace when the Bennis Machine Stokers are fed by means of Bennis elevators and conveyors. Bennis Coal and Ash-handling Plant has acknowledged advantages over other types. One marked advantage is the small amount of power required to operate it effectually.

Write for *"Common Sense Machine Stoking"* pamphlets and full particulars to:



A central station in the Midlands, England, where Bennis plant has established record economies.

G. H. TOD, 213 Manning Chambers Queen Street West **TORONTO**

The advertiser would like to know where you saw his advertisement—tell him.

ONTARIO.

Ottawa.—The Ottawa Artificial Ice Co. recently organized with T. C. Bate, president, has secured a site on Nicholas Street just south of Varsity oval, where they will build a 50-ton ice making plant to be ready for operation in April next. P. D. Lyons, it is stated, will be manager.

Ottawa.—The Ottawa Stadium Co. will erect an artificial ice skating rink next summer, the proposed rink on Isabella Street having been abandoned. The Stadium company will probably erect its proposed plant near that of the Ottawa Artificial Ice Co.

Toronto.—Plans are being completed by W. R. Perrin, Chicago, for the new municipal abattoir to be erected by the city in 1913, and to be equipped with large refrigerating plant.

Toronto.—W. H. Thorndyler has had his meat market equipped with a 4-ton refrigerating plant furnished by the York Manufacturing Co., York, Pa. Installation was by the Kent Co., Montreal, Que.

Toronto.—It is reported that the Ice Manufacturing Co., Ltd., who are building ice factories at Montreal and Winnipeg, have purchased a site in the northeast section, along the Canadian Pacific main line to Montreal, and will build there an ice factory of 200 tons daily capacity and an ice storage house of 50,000 tons capacity. A smaller plant, it is stated, will also be erected in the West end of the city.

Cornwall.—On December 23 the ratepayers sanctioned an agreement made between the Stormont Electric Light & Power Co., and the town council, whereby the town agrees to take the company's electric light and gas for ten years at a fixed rate.

Sarnia.—The Northern Navigation Co. will build at Pt. Edward an ice house of 20,000 tons capacity.

Niagara Falls.—Owing to the severe storm on Friday afternoon, Jan. 3, the transformer building of the Ontario Power Company was seriously damaged, due to a short circuit, the wires being blown down. The roof of the building was destroyed by fire, the loss amounting to $100,000. The lights in the city were out for a few hours.

QUEBEC.

Montreal.—The Ice Manufacturing Co., Ltd., who are erecting a large ice factory, have let contract for machinery for a first unit of 70 tons ice making capacity, to the Triumph Ice Machine Co., Cincinnati, O.

Montreal.—E. F. Baugh, 225 St. James St., and associates, have nearly completed the buildings for their new 200-ton plate ice plant on the Canadian Pacific Railroad at St. Denis Street. They desire tenders from builders of refrigerating machinery for the mechanical equipment of this plant.

Montreal.—E. & A. Leduc, meat dealers, have had their market equipped with an 8-ton "York" refrigerating plant, by the Kent Co., Ltd., Montreal.

Montreal.—Plans have been approved by the Light, Heat and Power Co. here for the construction of a new gas plant in the Cote St. Paul district which will cost nearly $3,000,000, and when completed late in 1914 will add 12,000,000 cubic feet of gas to the daily capacity of the company's plants. Other plants are also under contemplation.

City of Moose Jaw, Saskatchewan

TENDERS FOR ELECTRICAL MACHINERY

Sealed tenders marked "Tenders for turbo-generator" will be received by the City Commissioners, Moose Jaw, Sask., up to 12 o'clock noon on Monday, February 10th, 1913, for the manufacture, supply, delivery, and erection of one 1500 K.W. steam turbine and generator.

Specifications and General Conditions may be obtained upon application to J. D. Peters, Electrical Superintendent, Moose Jaw, the Commercial Intelligence Branch, Board of Trade, 73 Basinhall St.; or London Chamber of Commerce, London, England.

The lowest or any tender not necessarily accepted.

Signed,
A. W. MAYBERRY,
L. W. RUNDLETT,
W. F. HEAL,
Commissioners.

ELECTRICAL REPAIRS

Dynamo and motor winding, commutators refilled, coils rewound, etc.

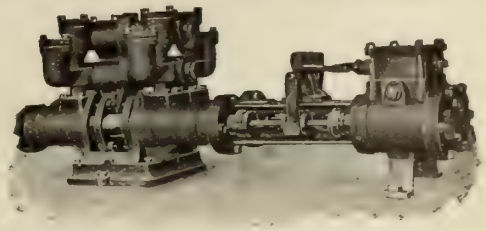
We want your business and guarantee satisfaction.

Write or call for quotation on your next motor job.

MEAD ELECTRIC CO., LIMITED

23 St. George Street **MONTREAL**

STEAM and POWER PUMPS, CONDENSERS, TRAVELLING CRANES



The SMART-TURNER MACHINE CO., Limited
Hamilton ***Canada***

CLASSIFIED ADVERTISING

FOR SALE

GAS ENGINES FOR SALE — 66 B.H.P. Hornsby-Stockport gas engine and plant, also 80 B.H.P. natural gas engine for immediate delivery. Particulars, Richard Hornsby & Sons, Limited, 212 McGill St., Montreal. (4)

BELTING FOR SALE—800,000 FEET OF best quality leather, rubber, hair and canvas belting, bought from bankrupt manufacturers at 25% to 75% less than the regular value. Also a large quantity of slightly used belting, piping, chains, rails, pulleys, hangers, cotton waste, etc., at very low prices. Send for catalogue. Imperial Belting and Supply Co., 5 Queen Street, Montreal.

SALESMEN WANTED

LAKE ERIE BOILER COMPOUND CO. REquire a few first-class representatives to sell their well-known compound. Liberal commission paid to live men, and exclusive territory. Write at once, giving references, 11 Colborne St., Toronto. (tf)

WANTED — EVERY POWER HOUSE IN Canada to remember that C. E. Shedrick, Craig Street West, Montreal, is still repairing measuring instruments, both switchboard and portable. Twenty-five years' experience in repairing all kinds and makes on the market. Integrating meters repaired, tested and sealed, and returned on quick time.

WANTED

MOST FAVORABLE TERMS WILL BE given to any firm wishful to take up sole agency for our Patent Flexible Metallic Face Steam Packings. S. Redfern & Co., Swan Lane, Manchester, England. (11)

WANTED—AN ENGINEER WITH A SUFFIcient knowledge of electricity to lay out and superintend the installation of steam boilers, engines, dynamos, lines, etc., in a new manufacturing plant. Good place for the right man. Address O. B. Mueller, care of Mueller Mfg. Co., Limited, Sarnia, Ont. (11)

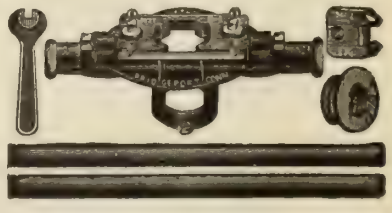
KEYSTONE FLEXIBLE STEEL MATS

Will Keep Your Feet Off Wet Floors

These Mats will prove invaluable to Breweries, Refrigeration Cos., etc. They are made of the best galvanized ribbon steel. No short links. Write for circulars.

KUHNE-ANDERTON MFG. CO.
PORT HOPE, ONT

U.S. BARKEEPERS FRIEND
METAL POLISH
USED AND ENDORSED BY THE LEADING DEALERS
SOLD ALL OVER THE WORLD



GENUINE ARMSTRONG STOCKS AND DIES FOR CUTTING PIPE & BOLTS ARE THE BEST.

PIPE MACHINES
PIPE CUTTERS
HINGED PIPE VISES
RATCHET ATTACHMENTS

Manufactured by
THE ARMSTRONG MFG. CO.
298 Knowlton St.
BRIDGEPORT, CONN.
NEW YORK ***CHICAGO***
Catalog mailed on request

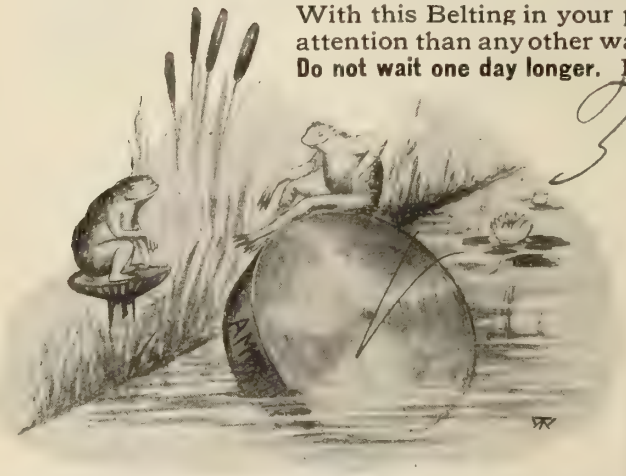
Thirty-Five Years Experience in the Manufacture of Leather Belting

Stands Back of Our

"AMPHIBIA"

(WATER-PROOF)

"The Proven Best For Wet Places"



With this Belting in your plant you will **save time and money** as it requires less attention than any other water-proof belt, with efficient transmission of power. **Do not wait one day longer.** Let us connect you with some users of "Amphibia" Belting—profit by their experience as to "Amphibia" service. Write for particulars.

Sadler & Haworth

Tanners and Manufacturers

MONTREAL
511 William St.

TORONTO
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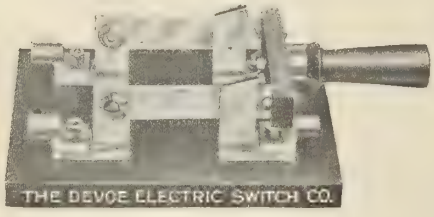
DEVOE
Type "C" Switches

(30-100 Amp.) **125-250-440-500 Volts.**

Have you tried our type "C" Switches, built of pure copper, with Standard form of bent jaws, and meeting the demand of a Standard Switch at a low price?



All our switches from 25-100 amperes are neatly packed in Cardboard Boxes and others are well parcelled and labelled, all ready for immediate shipment.

THE DEVOE ELECTRIC SWITCH COMPANY
Manufacturers
Office and Factory: **MONTREAL**

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A Study of Advertising and Selling from the standpoint of the New Principles of Scientific Management.

By Herbert N. Casson.

An Invaluable Book for the Manufacturer, Jobber and Retailer.

This is the first book which has attempted to apply the principles of Scientific Management to the Problems of Sales and Advertising.

Cloth-bound, Limited Edition, 167 pages.

Sent Postpaid on Receipt of $2 to any Address.

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143-149 University Avenue, Toronto

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ASK US about
Efficient Lighting

for your streets, factory, warehouse or yard.

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SCANDINAVIA BELTING — TORONTO

SPECIAL HIGH SPEED LEATHER BELTING.

LANCO BALATA BELTING

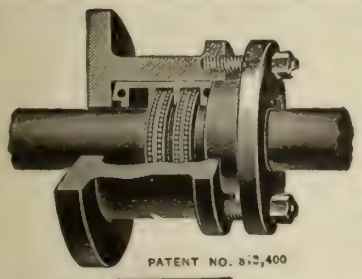
Federal Engineering & Supplies Limited
TORONTO MONTREAL

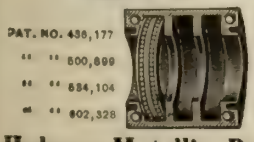
OHIO
Regulating Valves
are being used **exclusively** in many of the most prominent Rubber and Paper Plants, Hotels, Laundries, etc., simply because they regulate steam or air **accurately** and **continuously.**

Sold on 30 day trial—Your dealer can supply you promptly.

Write for Catalogue K-C.

THE OHIO BRASS CO.
Mansfield, Ohio





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HOLMES'
Metallic Packing
is Guaranteed 3 years

Lasts many times longer. 30 days trial. Less oil. No cutting. Easily applied to any Steam Engine, Air Compressor or Gas Engine. Satisfaction or no pay. Write us.

Holmes Metallic Packing Co., Wilkes-Barre, Pa.

ALLIGATOR BELT LACING

FLEXIBLE STEEL

Makes Joints Quickly.

Only a Hammer Required.

No Holes to Punch.

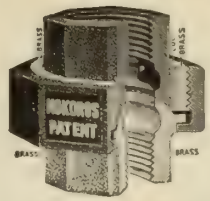
Forms the Strongest Part of The BELT.

Let Us Send One On Trial.

The Crescent Oil Company, Hamilton and Toronto, Ont

Stocks carried by—Sadler & Haworth, Montreal; Austen Bros., Halifax; P. A. Gouin, Three Rivers, P.Q.; J. S. Mitchell & Co., Sherbrooke, P.Q.; Great West Engine Packing Co., Winnipeg; F. H. Andrews & Son, Quebec, P.Q.; E. N. Jones, St. John, N.B.

The Nokoros Patent Union



The only union made absolutely Non-Corrosive. Brass to iron in all contact points. Ball joint; Octagon ends, any wrench can be used. Adapted for heavy service. Every union air tested at factory. Send for circular B, describing the above and other fittings made by

Guaranteed Tested & D

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OTTERVILLE, ONTARIO

Mueller Pressure Reducing and Regulating Valves

Give accurate and absolute control of pressures of water, steam, air, gas, oil, carbonic and acetylene gases—in fact, all kinds of pressures. Their efficiency is firmly established. Manufactured under Canadian patent No. 127,566. Address:

DOHERTY MFG. CO., Limited
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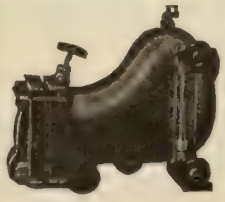
Manufacturer for The H. MUELLER MFG. CO., Decatur, Ill., and New York City.



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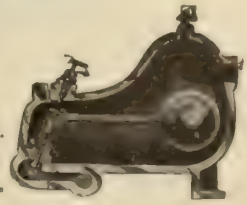
FOR HIGH OR LOW PRESSURE.

Steam can't blow through. They have large discharge valves and cannot be flooded from sudden flushes of water.

MAY WE SEND ONE FOR TRIAL?

Reducing Valves, Pump Governors, Relief Valves, Exhaust Pipe Heads, Ejectors and Steam Separators. SEND FOR CATALOGUE.



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26 Craig St. MONTREAL, CAN.

WATSON & McDANIEL CO.,
No. 146 N. 7th St. PHILADELPHIA, Pa.

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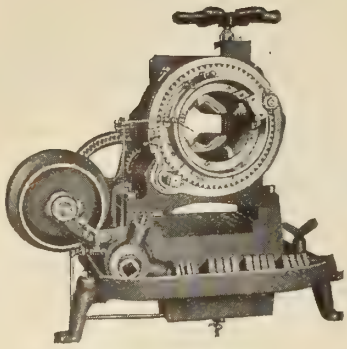


The Forbes Pipe Cutting and Threading Machines

have stood the test for over thirty years.

Simple, economical, reliable, durable, highest efficiency.

Save the labor of from one to four men with our hand machines and power machines; require one quarter the floor space and one half the power of the lathe bed type.

Can you afford to be without one? Let us send you our new catalogue.

THE CURTIS & CURTIS CO. 26 GARDEN STREET BRIDGEPORT, CONN.

Ideas at 2 Cents Each

¶ An idea that's worth anything at all to a Power Plant man is worth more than two cents.

¶ It might be worth hundreds of dollars.

¶ Every issue of "THE POWER HOUSE" is full of practical, helpful ideas. You ought to be able to sift out four each month that would prove of some use to you. Put a value of two cents on each and your subscription has been paid.

¶ You cannot afford to miss even one issue—you might miss the idea that would be worth hundreds of dollars.

¶ The date on the label of your "POWER HOUSE" wrapper shows when your subscription expires. One dollar will renew it for a year.

Don't put off Renewing—Do it to-day
Neglect blew up the Boiler

DIXON'S GRAPHITE LUBRICANTS

Dixon's Flake Graphite No. 1.

This is the standard size of Dixon's Ticonderoga Flake Graphite, and is recommended for general lubricating requirements.

Dixon's Flake Graphite No. 2

A more finely ground graphite than No. 1, though of the same stock. This is adapted to close-fitting bearings and delicate mechanism.

Dixon's Special Graphite No. 635

This is a selected grade of Dixon's Ticonderoga Flake Graphite ground even finer than the No. 2 Flake. It is widely used in stationary gas engines. This grade of graphite is also used on type-setting machinery.

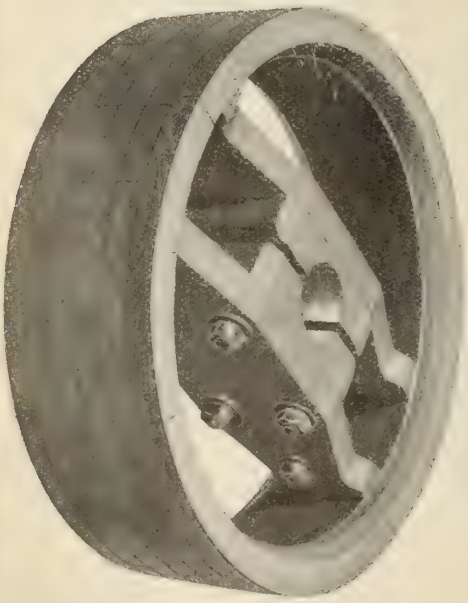
Dixon's Waterproof Graphite Grease

A strongly adhesive grease of heavy body; cannot be washed off by fresh, salt, alkaline, or acid water. Especially adapted for wire rope, gears, slides, chains, elevator-ways, mining and quarrying machinery, and generally on machinery exposed to water or the weather.

"Graphite As A Lubricant," and Sample 222C free.

JOSEPH DIXON CRUCIBLE CO.
Jersey City, N.J.

A Combination Hard to Beat

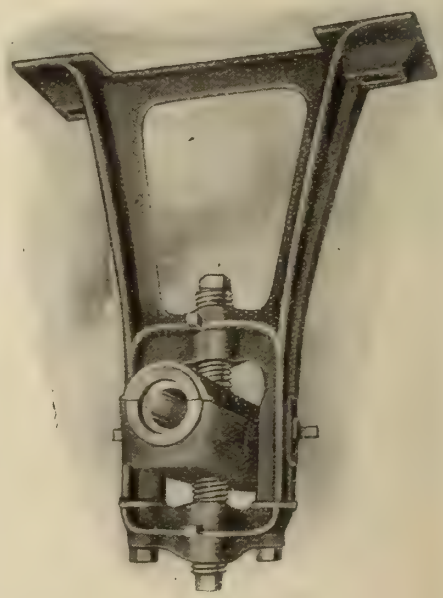


Elmira Ball and Socket Hangers
Elmira Wood Split Pulleys

The Elmira B. & S. Hangers are designed to meet the hardest and most exacting conditions. They are of good weight, correct design, and well proportioned. A Duplex system of oiling is employed consisting of tempered steel rings and woven cotton wick.

The Elmira Pulley is built to stand the hardest service and most severe conditions. The rim is nailed throughout. The arms are tenoned into the rim and dowelled there. The pulley is guaranteed to run wherever a leather belt will give satisfaction.

Send for our Illustrated Catalogue "C."



Large and complete stocks carried at Elmira, and by

The A. M. ELLICOTT CO., 301 St. James Street, Montreal, Que., Sole Eastern Agents.

Elmira Machinery & Transmission Co., Limited - - Elmira, Canada

Self-Lubricating

In Cans
6, 12, 25 and 50 lbs.

SAFETY PLASTIC
METALLIC PACKING
LASTS FOR YEARS AND NEVER WEARS THE PISTON ROD

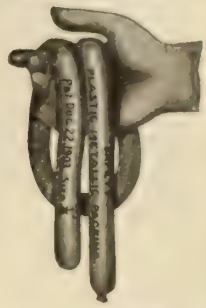
Guaranteed to stand steam temperature up to 550 degrees Fahr.
Guaranteed to stand hydraulic pressure to 5000 pounds per square inch
Packing furnished in bulk and in thin Cotton Tubes, sizes 3-16 to 1½ inch, 36 inches long, or in special lengths to fit your stuffing boxes.
Empty Cotton Tubing in assorted sizes FREE OF CHARGE with orders for the packing in bulk form.
The tubes are easily filled and they save you the expense of carrying a large stock of packings in different sizes.

Send for FREE SAMPLE and particulars

Manufactured only by

STEEL MILL PACKING CO. : WINDSOR, ONT.

Practically Frictionless



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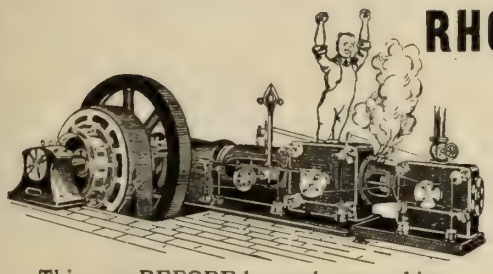

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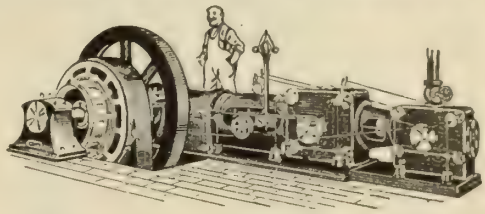
RHODES IMPROVED METALLIC PACKING

THE PACKING
THAT PACKS

A trial will convince you.

Beware of Imitations.



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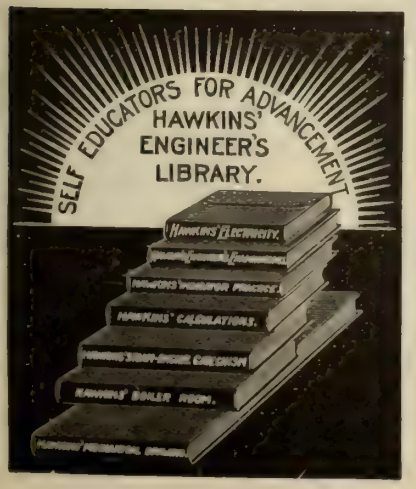
WRITE TO-DAY FOR PARTICULARS

The Rhodes Improved Metallic Packing Co., Limited
55 St. Francois Xavier Street, - - - MONTREAL

When All Others Fail

GERMAN VALVE CYLINDER OIL,
GERMAN ENGINE OIL,
STERLING FAST ENGINE AND DYNAMO OIL,
STERLING FRICTIONLESS COMPOUND
will cure your troubles.

Canadian Oil Companies Limited,
Toronto, Winnipeg, Montreal, St. John, Halifax, Calgary.



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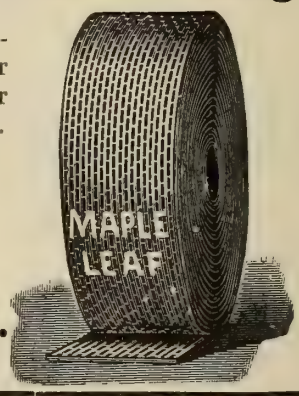

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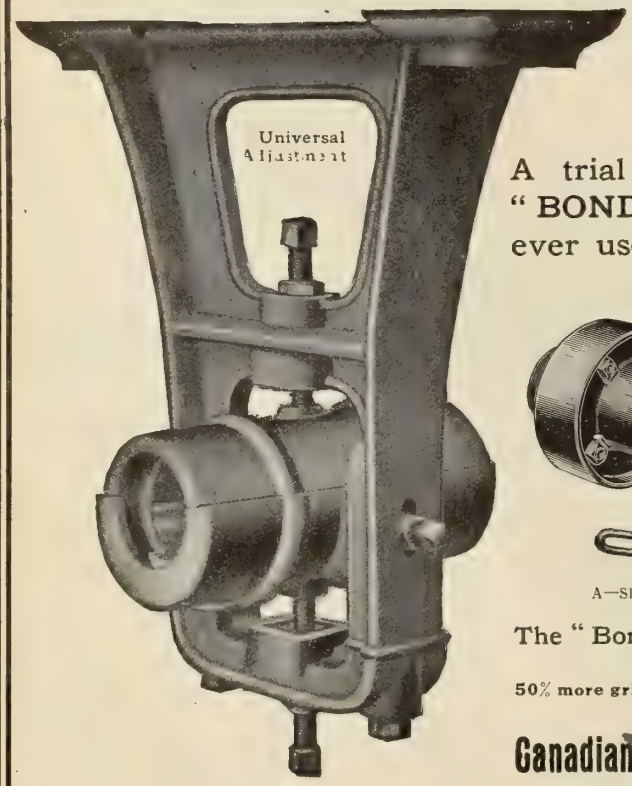

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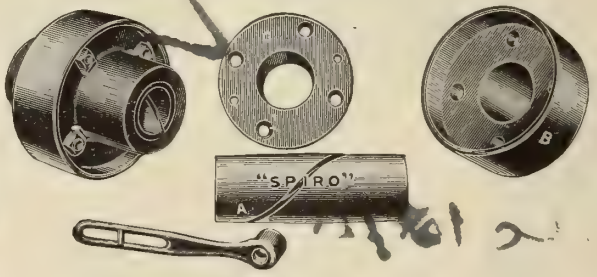

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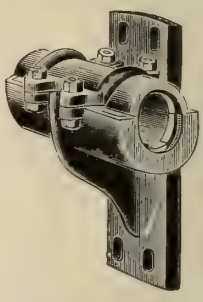

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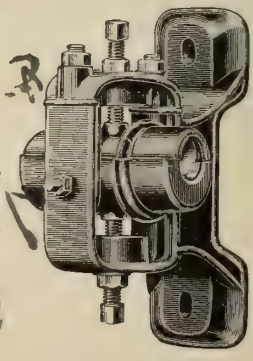

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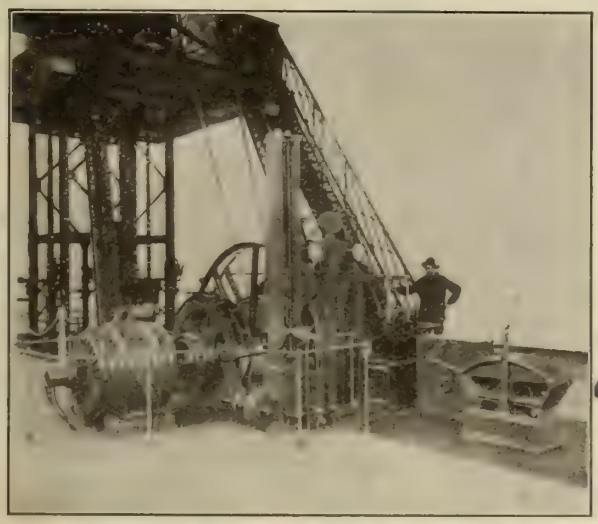

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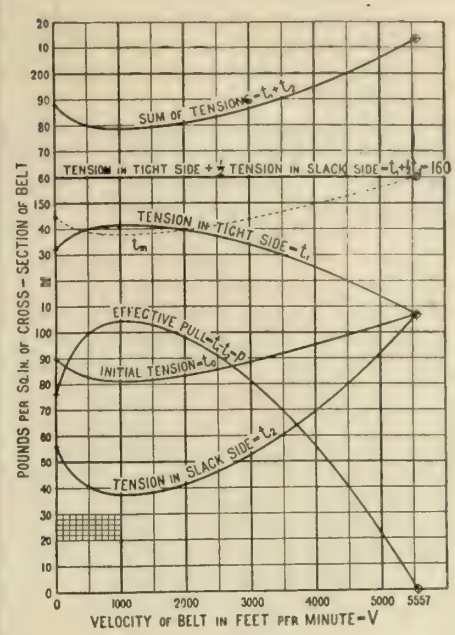
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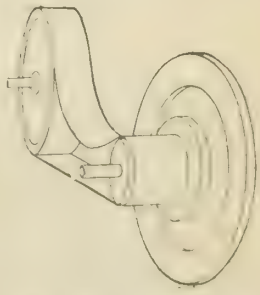

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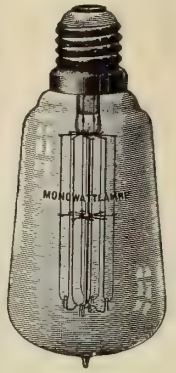

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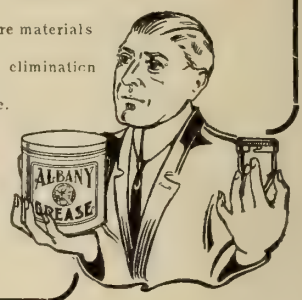

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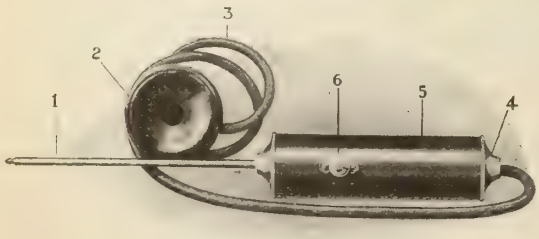

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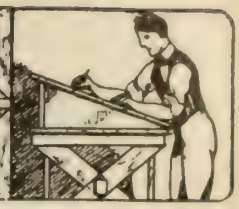

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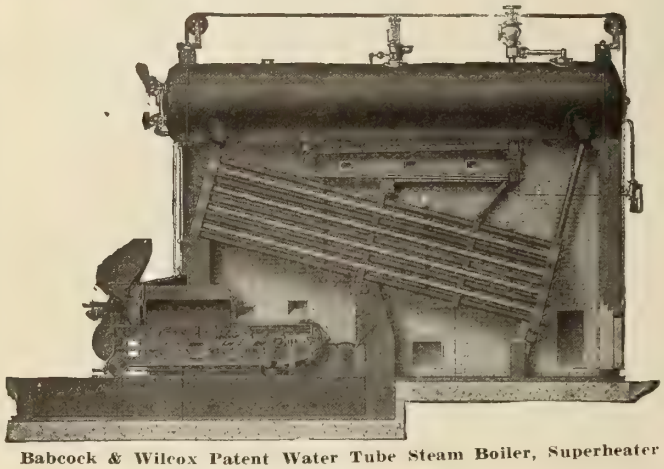

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Waterous Engine Wks. Co., Brantford

Coal and Ash Conveyors.
Babcock & Wilcox, Montreal.
Ed. Bennis & Co., Ltd.
Hare Eng. Co., Toronto.
Jeffrey Mfg. Co., Columbus, O.
H. L. Peiler & Co., Montreal.
Geo. H. Tod, Toronto.

Coal Handling Machinery.
C. O. Bartlett & Snow Co., Montreal
Ed. Bemis & Co., Ltd.
Hare Eng. Co., Toronto.
Geo. H. Tod, Toronto.
Jeffrey Manufacturing Co., Columbus.

Cold Storage Architects.
E. J. Greenstreet, Toronto.

Cold Storage Insulation.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.

Condensers.
W. H. Allen Son & Co. Bedford, Eng.
Alberger Condenser Co., New York.
American Steam Pump Co., Battle Creek, Mich.
Canada Fdry. Co., Ltd., Toronto.
Canadian Boving Co., Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
Fraser & Chalmers, Ltd., Montreal.
Goldie & McCulloch Co., Galt.
John McDougall Caledonian Iron Wks, Montreal.
H. L. Peiler & Co., Montreal.
Hare Eng. Co., Toronto.
Waterous Engine Wks. Co., Brantford

Cold Store Doors and Windows.
Jones Cold Store Door Co., Hagerstown, Md.

Condensation Receiver.
G. M. Davis Regulator Co., Chicago.

Conduits.
E. Leonard & Sons, London, Ont.
Can. H. W. Johns-Manville Co., Toronto.

Consulting Engineers.
Bayfield & Archibald, Vancouver, B.C
Chas. Bishop, M.I.C.S.A., Montreal.
de Gaspe Beaubien, Montreal.
W. N. Dietrich, Montreal.
John T. Farmer, Montreal.
Fetherstonhaugh & Co., Montreal.
Walter J. Francis, Montreal.
Jacobs & Davies, Inc., Montreal.
Pratt & Ross, Toronto.
J. M. Robertson, Montreal.
J. M. Shanly, Montreal.
A. V. Tracy-Gould, Montreal.

Contractors, Structural Steel.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Canada Fdry. Co., Ltd., Toronto.

Conveyor Machinery.
C. O. Bartlett & Snow Co., Montreal
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Engineering Works of Canada, Ltd., Montreal.
Jeffrey Manufacturing Co., Columbus.
Waterous Engine Wks. Co., Brantford

Conveyor Belting.
C. O. Bartlett & Snow Co., Montreal

Cooler Doors.
Jones Cold Store Door Co., Hagerstown, Md.

Cooling Towers.
Alberger Condenser Co., New York.

Copper Rods.
Standard Underground Cable Co., of Canada, Ltd., Hamilton, Ont.

Cork Insulation.
Can. H. W. Johns-Manville Co., Toronto.

Cotton Hose.
Garlock Packing Co., Hamilton, Ont.
Quaker City Rubber Co., Philadelphia.

Couplings.
Canadian Boving Co., Toronto.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Dunlop Tire and Rubber Goods Co., Toronto.
Elmira Machinery and Transmission Co., Elmira.
General Supply Co. of Can., Ottawa.
Jeffrey Manufacturing Co., Columbus.
Manitoba Bridge & Iron Works, Ltd., Winnipeg.
J. C. Wilson & Co., Glenora, Ont.

Cranes, Electric.
Babcock & Wilcox, Montreal.
Canada Fdry Co., Ltd., Toronto.

Crank and Crosshead Pin Oilers
Lunkenheimer Co., Cincinnati, O.

Crushing Machinery.
C. O. Bartlett & Snow Co., Montreal
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundry Co., Ltd., Toronto.
Fraser & Chalmers, Ltd., Montreal.

Damper Regulators.
Darling Bros., Montreal.
G. M. Davis Regulator Co., Chicago, Ill.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
Jas. Morrison Brass Mfg. Co., Toronto.
H. L. Peiler & Co., Montreal.

Detector Phones.
The Maihak Indicator Agency, Montreal.

Doors, Cold Storage and Freezer.
Jones Cold Store Door Co., Hagerstown, Md.

Drying Machinery.
Can. Fairbanks-Morse Co., Montreal.

Dynamos.
W. H. Allen Son & Co. Bedford, Eng.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.

Economizers.
Babcock & Wilcox, Montreal.
Can. Fairbanks-Morse Co., Montreal.

Ejectors.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.

Electric Fans.
Canadian General Electric Co., Ltd., Toronto.

Electrical Accessories and Machinery.
W. H. Allen Son & Co. Bedford, Eng.
Can. Fairbanks-Morse Co., Montreal.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Canadian H. W. Johns-Manville Co., Toronto.
Engineering Works of Canada, Ltd., Montreal.
Monarch Electric Co., St. Lambert, Que.
Northern Electric & Mfg. Co., Limited Montreal.
Railway Equipment Co., Toronto.

Electrical Repairs.
Mead Electric Co., Montreal.

Electric Railway Equipment.
Railway Equipment Co., Toronto.

Elevators.
Engineering Works of Canada, Ltd., Montreal.
John McDougall Caledonian Iron Wks, Montreal.

Elevating Machinery.
C. O. Bartlett & Snow Co., Montreal
Can. Fairbanks-Morse Co., Montreal.
Engineering Works of Canada Ltd., Montreal.
Goldie & McCulloch Co., Galt.
Jeffrey Manufacturing Co., Columbus.
Waterous Engine Works Co., Brantford.

Engineers' Supplies.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.

Engines, Automatic and Drop Valve.
Fraser & Chalmers, Ltd., Montreal.
E. Leonard & Sons, London, Ont.
Robb Engineering Co., Amherst, N.S.
Waterous Engine Works Co., Brantford.

Engines, Corliss and Rocking Valve.
Fraser & Chalmers, Ltd., Montreal.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que
E. Leonard & Sons, London, Ont.
Robb Engineering Co., Amherst, N.S.
Waterous Engine Works Co., Brantford.

Engines, Gas and Gasoline.
W. H. Allen Son & Co. Bedford, Eng.
Canada Foundry Co., Ltd., Toronto.
Canadian Boving Co., Toronto
Canadian Westinghouse Co., Hamilton.
Fraser & Chalmers, Ltd., Montreal.
General Supply Co. of Canada, Ottawa
Keighley Gas Engine Co., Keighley, Eng.
E. Leonard & Sons, London, Ont.
John Robson (Shipley) Ltd., Shipley, Eng.

Engines, High Speed, Steam.
W. H. Allen Son & Co, Bedford, Eng.
Canadian Boving Co., Toronto.
Engineering Works of Canada, Ltd., Montreal.
Goldie & McCulloch Co., Galt.
Laurie & Lamb, Montreal.
E. Leonard & Sons, London, Ont.
John McDougall Caledonian Iron Wks, Montreal.
Robb Engineering Co., Amherst, N.S.
Waterous Engine Works Co., Brantford.
Railway Equipment Co., Toronto.

Engines, Marine.
W. H. Allen Son & Co. Bedford, Eng.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
General Supply Co. of Canada, Ottawa
E. Leonard & Sons, London, Ont.
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Engines, Saw Mill.
W. H. Allen Son & Co. Bedford, Eng.
Fraser & Chalmers, Ltd., Montreal.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que
Laurie & Lamb, Montreal.
E. Leonard & Sons, London, Ont.
Robb Engineering Co., Amherst, N.S.
Waterous Engine Works Co., Brantford.

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W. H. Allen Son & Co. Bedford, Eng.
Canadian Boving Co., Toronto.
Fraser & Chalmers, Ltd., Montreal.
Jenckes Machine Co., Sherbrooke, Que.
Laurie & Lamb, Montreal.
E. Leonard & Sons, London, Ont.
John McDougall Caledonian Iron Wks, Montreal.
Kerr Engine Co., Walkerville.
Robb Engineering Co., Amherst, N.S.
Waterous Engine Works Co., Brantford.
Railway Equipment Co., Toronto.

Engines, Vertical.
W. H. Allen Son & Co. Bedford, Eng.
General Supply Co. of Canada Ottawa
Laurie & Lamb, Montreal.
E. Leonard & Sons, London, Ont.
Robb Engineering Co., Amherst, N.S.
Railway Equipment Co., Toronto.

Excavators.
C. O. Bartlett & Snow Co., Montreal

Engineers' Supplies.
Lunkenheimer Co., Cincinnati, O.

Exhaust Fans.
W. H. Allen Son & Co. Bedford, Eng.
General Supply Co. of Canada, Ottawa
Hare Eng. Co., Toronto.

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Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
Jas. Morrison Brass Mfg. Co., Toronto.
The Sims Co., Erie, Pa.
Steam Appliance Co., Milwaukee, Wis.
Watson & McDaniel Co., Philadelphia

Expansion Joints.
Alberger Condenser Co., New York.
Lunkenheimer Co., Cincinnati, O.

Feed Water Alarms.
H. L. Peiler & Co., Montreal.

Feed Water Analyser.
Dearborn Chemical Co., Chicago.
C. C. Snowdon, Calgary.

Feed Water Heaters.
Alberger Condenser Co., New York.
Babcock & Wilcox, Montreal.
Can. Fairbanks-Morse Co., Montreal.
Canada Foundry Co., Ltd., Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
Elliott Co., Pittsburgh, Pa.
General Supply Co. of Canada, Ottawa
Hare Eng. Co., Toronto.
National Pipe Bending Co., New Haven, Conn.
H. L. Peiler & Co., Montreal.
Robb Engineering Co., Amherst, N.S.
The Sims Co., Erie, Pa.
Waterous Engine Works Co., Brantford.

Feed Water Regulators.
Canada Foundry Co., Ltd., Toronto.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
H. L. Peiler & Co., Montreal.

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John McDougall Caledonian Iron Wks, Montreal.

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Dunlop Tire and Rubber Goods Co., Toronto.
Quaker City Rubber Co., Philadelphia, Pa.

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Alex. Gibb, Montreal.

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Jones Cold Store Door Co., Hagerstown, Md.

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Dart Union Co., Toronto.
General Supply Co. of Canada, Ottawa
Lunkenheimer Co., Cincinnati, O.

Flue Brushes.
General Supply Co. of Canada, Ottawa
Steam Appliance Co., Milwaukee, Wis.

Flumes, Steel.
Canada Foundry Co., Ltd., Toronto.
Canadian Boving Co., Toronto.
E. Leonard & Sons, London, Ont.

Freezer Doors.
Jones Cold Store Door Co., Hagerstown, Md.

Insulators.
Ed. Bennis & Co., Ltd.
Geo. H. Tod, Toronto.

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Hare Eng. Co., Toronto.

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Canadian General Electric Co., Ltd., Toronto.

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Goetze-Gasket & Packing Co., New Brunswick.
Canadian H. W. Johns-Manville Co. Ltd., Toronto.
Dunlop Tire and Rubber Goods Co., Toronto.
Garlock Packing Co., Hamilton, Ont.
General Supply Co. of Canada, Ottawa

Gas Exhausters.
Hare Eng. Co., Toronto.

Gas Producer Plants.
Canadian Boving Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Canada Foundry Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Fraser & Chalmers, Ltd., Montreal.
E. Leonard & Sons, London, Ont.

Gauge Cocks.
Can. Fairbanks-Morse Co., Montreal.
General Supply Co. of Canada, Ottawa
Hare Eng. Co., Toronto.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
Ohio Brass Co., Mansfield, Ohio.
H. L. Peiler & Co., Montreal.
W. J. Wall, Montreal.
Garlock Packing Co., Hamilton, Ont.
Lunkenheimer Co., Cincinnati, O.

Gauges—Pressure, Vacuum, Draft and Recording.
Babcock & Wilcox, Montreal.
Lunkenheimer Co., Cincinnati, O.
H. L. Peiler & Co., Montreal.

Gauges, Water.
Jenkins Bros., Ltd., Montreal.

Gears, Cut, Worm, Mortise.
J. C. Wilson & Co., Glenora, Ont.

Gears, Spur Level.
Manitoba Bridge & Iron Works Limited, Winnipeg.
J. C. Wilson & Co., Glenora, Ont.

Generators.
W. H. Allen Son & Co. Bedford, Eng.
Can. Fairbanks-Morse Co., Montreal.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co. Hamilton
Engineering Works of Canada, Ltd., Montreal.
Northern Electric & Mfg. Co., Limited, Montreal.

Governors, Water Wheel
W. H. Allen Son & Co. Bedford, Eng.
J. C. Wilson & Co., Glenora, Ont.

Graphite.
Jos. Dixon Crucible Co., Jersey City.
General Supply Co. of Canada, Ottawa
C. C. Snowdon, Calgary.

Graphitol.
British Pacific Supply Co., Victoria, B.C.

Grates.
Babcock & Wilcox, Montreal.
Ed. Bennis & Co., Ltd.
Boiler Repair & Grate Bar Co., Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Hare Eng. Co., Toronto.
H. L. Peiler & Co., Montreal.
Geo. H. Tod, Toronto.

Grease Cups.
Adams Cooks Son, New York.
Albany Lubricating Co., New York.
Detroit Lubricator Co., Walkerville.
General Supply Co. of Canada, Ottawa
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
F. J. Schuch, Toronto.

Grease and Oil Extractors.
Canada Foundry Co., Ltd., Toronto.
Elliott Co., Pittsburgh, Pa.
C. C. Snowdon, Calgary.
Hare Eng. Co., Toronto.
Steam Appliance Co., Milwaukee, Wis.

Greases.
Adams Cooks Son, New York.
Albany Lubricating Co., New York.
British Pacific Supply Co., Victoria, B. C.
Can. Fairbanks-Morse Co., Montreal.
Can. Oil Companies, Ltd., Toronto.
Jos. Dixon Crucible Co., Jersey City.
C. C. Snowdon, Calgary.

Hangers.
Can. Bond Hanger & Coupling Co., Alexandria.
C. O. Bartlett & Snow Co., Montreal
Can. Fairbanks-Morse Co., Montreal.
Elmira Machinery and Transmission Co., Elmira.
General Supply Co. of Canada, Ottawa
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.
J. C. Wilson & Co., Glenora, Ont.

Heaters.
Alberger Condenser Co., New York.
Canada Foundry Co., Toronto.
Darling Bros., Montreal.
General Supply Co. of Canada, Ottawa
Goldie & McCulloch Co., Galt.
Hare Eng. Co., Toronto.
E. Leonard & Sons, London, Ont.
H. L. Peiler & Co., Montreal.
The Sims Co., Erie, Pa.

Hoists.
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Engineering Works of Canada, Ltd., Montreal.

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F. J. Schuch, Toronto.

Hose, Steam, Suction and Water.
Dunlop Tire & Rubber Goods Co., Toronto.
Garlock Packing Co., Hamilton, Ont.

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Canada Foundry Co., Ltd., Toronto.

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W. H. Allen Son & Co. Bedford, Eng.
The Deming Co., Salem, O.
Engineering Works of Canada, Ltd., Montreal.
John McDougall Caledonian Iron Wks, Montreal.

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Bawdon Machine Co., Toronto.

Hydro Extractors.
Jones & Glassco, Montreal.

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Linde British Refrigeration Co., Montreal.

Indicators, Electric—All Types.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton

Indicators, Steam and Gas Engine.
Can. Fairbanks-Morse Co., Montreal.
H. L. Peiler & Co., Montreal.
The Maihak Indicator Agy., Montreal.

Indicators—Ammonia, Hydraulic.
Detroit Lubricator Co., Walkerville.

Indicating.
Renown Engine & Machine Co., Montreal.

Injectors.
General Supply Co. of Canada, Ottawa
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
Penberthy Injector Co., Windsor.

Insulating Compounds.
Standard Underground Cable Co., of Canada, Ltd., Hamilton, Ont.

Insulating Tapes & Varnishes.
Standard Underground Cable Co., of Canada, Ltd., Hamilton, Ont.

Furnaces.
Monarch Electric Co., St. Lambert, Que.

Iron Filler.
Imperial Waste & Metal Co., Montreal.

Lamps, Tungsten, etc.
Canadian General Electric Co., Ltd., Toronto.

Lamps, Arc, Incandescent.
Canadian General Electric Co., Ltd., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Canadian Westinghouse Co., Hamilton
P. H. Klein, Jr., Co., Montreal.
Northern Electric & Mfg. Co., Limited, Montreal.
A. H. Winter Joyner, Toronto.

Lubricants.
Adams Cooks Son, New York.
Albany Lubricating Co., New York.
British Pacific Supply Co., Victoria.
Can. Oil Companies, Ltd., Toronto.
Jos. Dixon Crucible Co., Jersey City.
C. C. Snowdon, Calgary.

Lubricators, Force Feed.
Adams Cooks Son, New York.
Albany Lubricating Co., New York.
Darling Bros., Montreal.
Can. Detroit Lubricator Co., Windsor,
General Supply Co. of Canada, Ottawa
Lunkenheimer Co., Cincinnati, O.
Manzel Bros. Co., Buffalo, N.Y.

Lubricators, Plain.
Can. Detroit Lubricator Co., Windsor, Ont.
General Supply Co. of Canada, Ottawa
Lunkenheimer Co., Cincinnati, O.

Mats—Rubber, Steel.
Dunlop Tire & Rubber Goods Co., Toronto.
Kuhne-Anderton Mfg. Co., Port Hope, Ont.

Mechanical Stokers.
Babcock & Wilcox, Montreal.
Ed. Bennis & Co., Ltd.
Fraser & Chalmers, Ltd., Montreal.
Hare Eng. Co., Toronto.
Jones Underfeed Stoker Co., Toronto.
Murphy Iron Works, Detroit, Mich.
Geo. H. Tod, Toronto.

Metal Cutting (Oxy-Hydrogen).
Franco-Can. Welding Co., Toronto.

Metal Welding.
Franco-Can. Welding Co., Toronto.

Meters, Electric.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Monarch Electric Co., St. Lambert, Que.

Meters, Water.
H. L. Peiler & Co., Montreal.

Mica.
Kent Brothers, Kingston, Ont.

Mill and Mining Machinery.
W. H. Allen Son & Co. Bedford, Eng.
Can. Fairbanks-Morse Co., Montreal.
Engineering Works of Canada, Ltd., Montreal.
Fraser & Chalmers, Ltd., Montreal.
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co. Sherbrooke, Que
Robb Engineering Co., Amherst, N.S.
Railway Equipment Co., Toronto.
Waterous Engine Works Co., Brantford.
J. C. Wilson & Co., Glenora, Ont.

Molds, Rubber.
Bawdon Machine Co., Toronto.

Motors.
W. H. Allen Son & Co. Bedford, Eng.
Can. Fairbanks-Morse Co., Montreal.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.
Northern Electric & Mfg. Co., Limited, Montreal.
Railway Equipment Co., Toronto.

Motor Starters and Controllers.
W. H. Allen Son & Co. Bedford, Eng.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.

Office Railings.
Jas. Morrison Brass Mfg. Co., Toronto.

Oil Cups.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.

Oiler Compound Feeders.
Lunkenheimer Co., Cincinnati, O.

Oilers, Gauge.
Lunkenheimer Co., Cincinnati, O.

Oilers, Multiple.
Can. Detroit Lubricator Co., Windsor,
Lunkenheimer Co., Cincinnati, O.

Oil Filters.
Darling Bros., Montreal.
Elliott Co., Pittsburgh, Pa.
General Supply Co. of Canada, Ottawa
Jas. Morrison Brass Mfg. Co., Toronto.
The Sims Co., Erie, Pa.

Oil Separators, Ammonia.
Steam Appliance Co., Milwaukee,

Oil Separators.
Babcock & Wilcox, Montreal.
Can. Fairbanks-Morse Co., Montreal.
Canada Foundry Co., Ltd., Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
C. A. Dunham Co., Toronto.
Elliott Co., Pittsburgh, Pa.
General Supply Co. of Canada, Ottawa
Hare Eng. Co., Toronto.
Liberty Mfg. Co., Pittsburg.
Jas. Morrison Brass Mfg. Co., Toronto.
Steam Appliance Co., Milwaukee

Oils, Lubricating.
Adams Cooks Son, New York.
Albany Lubricating Co., New York.
British Pacific Supply Co., Victoria.
Can. Oil Companies, Ltd., Toronto.
Dearborn Chemical Co., Chicago.
C. C. Snowdon, Calgary.

Oxy-Acetylene Welding.
Franco-Can. Welding Co., Toronto

Packing Engine.
Can. H. W. Johns-Manville Co., Toronto.
Dunlop Tire & Rubber Goods Co., Toronto.
Garlock Packing Co., Hamilton, Ont.
General Supply Co. of Canada, Ottawa
Steel Mill Packing Co., Windsor, Ont.

Packing, Metallic.
General Supply Co. of Canada, Ottawa
Holmes Metallic Packing Co., Wilkesbarre, Pa.
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Rhodes Improved Metallic Packing Co., Ltd., Montreal.
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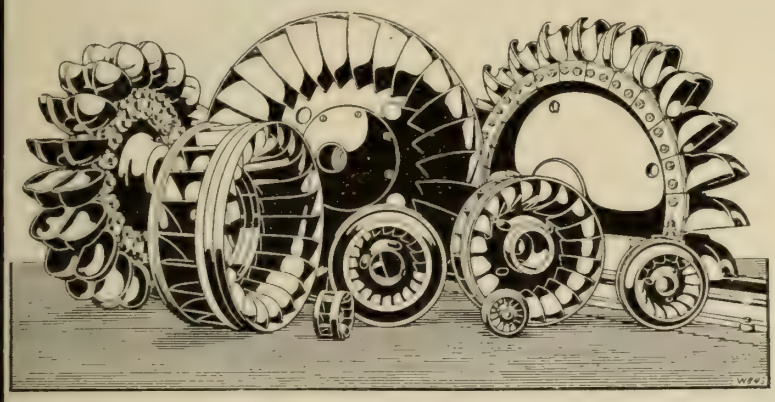

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Garlock Packing Co., Hamilton, Can.
General Supply Co. of Canada, Ottawa
Steel Mill Packing Co., Windsor, Ont

Packing, Sheet.
Dunlop Tire & Rubber Gods Co., Toronto.
Garlock Packing Co., Hamilton, Can.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.
General Supply Co. of Canada, Ottawa
Jenkins Bros., Ltd., Montreal.
Quaker City Rubber Co., Philadelphia, Pa.
F. J. Schuch, Toronto.

Packing, Ammonia, Steam and Water.
Canadian H. W. Johns-Manville Co., Toronto.
Dunlop Tire and Rubber Goods Co., Toronto.
Garlock Packing Co., Hamilton, Can.
General Supply Co. of Canada, Ottawa
Quaker City Rubber Co., Philadelphia, Pa.
F. J. Schuch, Toronto.
Steel Mill Packing Co., Windsor, Ont.

Packing, Rubber.
Dunlop Tire and Rubber Goods Co., Toronto.

Panel Boards.
Devoe Electric Switch Co., Montreal.
Hill Electric Switch Co., Montreal.

Packing Rubber.
Dunlop Tire and Rubber Goods Co., Toronto.

Patents.
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Canada Foundry Co., Ltd., Toronto.
Canadian Booving Co., Toronto.

Penstock Lugs.
Otterville Mfg. Co., Otterville, Ont.

Pillow Blocks.
Can. Bond Hanger & Coupling Co., Alexandria.
Elmira Machinery & Transmission Co., Elmira, Ont.
J. C. Wilson & Co., Glenora, Ont.

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National Pipe Bending Co., New Haven, Conn.

Pipe Cutting and Treading Machine and Tools.
Can. Fairbanks-Morse Co., Montreal.
Curtis & Curtis Co., Bridgeport, Conn

Pipe, Steel.
Canada Foundry Co., Ltd., Toronto.
Canadian Boving Co,. Toronto.
E. Leonard & Sons, London, Ont.

Pipe (Second-Hand).
Imperial Waste & Metal Co., Montreal.

Pipes, Water.
Canada Foundry Co. Ltd., Toronto.
Canadian Boving Co., Toronto.
Pacific Coast Pipe Co., Vancouver, B. C.

Piping and Fittings.
Jas. Morrison Brass Mfg. Co., Toronto.

Piping, Steam.
Babcock & Wilcox, Montreal.
Imperial Waste & Metal Co., Montreal.

Planimeters.
H. L. Peiler & Co., Montreal.

Plate Work.
Canada Foundry Co., Ltd., Toronto.
Fraser & Chalmers, Ltd., Montreal.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

Plumbing Machinery.
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Polish, Metal.
G. W. Hoffman, Indianapolis.

Power Pumps.
W. H. Allen Son & Co. Bedford, Eng.
American Steam Pump Co., Battle Creek, Mich.
Canadian Boving Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Canada Foundry Co., Ltd., Toronto.
Darling Bros., Montreal.
Deming Co., Salem, O.
General Supply Co. of Canada, Ottawa
Goldie & McCulloch Co., Galt.
Goulds Pump Co., Montreal.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.
Dunlop Tire & Rubber Goods Co., Toronto.
Garlock Packing Co., Hamilton, Can.

Power Transmission Machinery.
Can. Fairbanks-Morse Co., Montreal.
Elmira Machinery & Transmission Co., Elmira, Ont.
Engineering Works of Canada, Ltd., Montreal.
General Supply Co. of Canada, Ottawa
Goldie & McCulloch Co., Galt.
Jeffrey Manufacturing Co., Columbus.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.
J. C. Wilson & Co., Glenora, Ont.

Pulleys.
C. O. Bartlett & Snow Co., Montreal
Can. Fairbanks-Morse Co., Montreal.
Crescent Oil Co., Hamilton, Ont.
Elmira Machinery and Transmission Co., Elmira, Ont.
General Supply Co. of Canada, Ottawa
Jeffrey Manufacturing Co., Columbus.
Manitoba Bridge & Iron Works Limited, Winnipeg.
Waterous Engine Works Co., Brantford.
J. C. Wilson & Co., Glenora, Ont.

Pulp Mill Machinery.
W. H. Allen Son & Co. Bedford, Eng.
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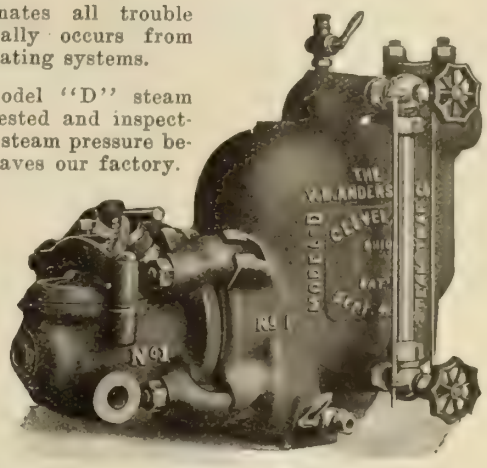

All parts are interchangeable. The removable perforated strainer, which is part of the equipment, prevents pieces of scale, packing, lead, etc., from entering trap. By our system any **traps can be changed from high to low pressure** or vice versa by simply ordering the necessary valves and seat for pressure desired.

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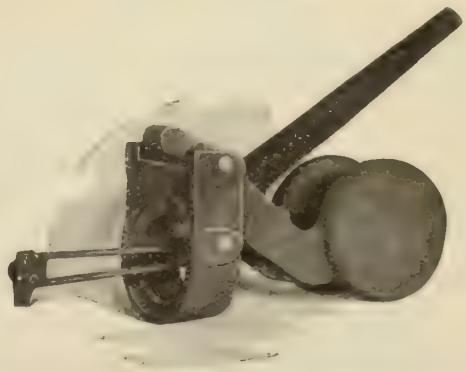

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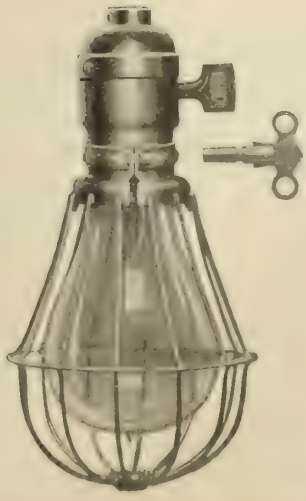

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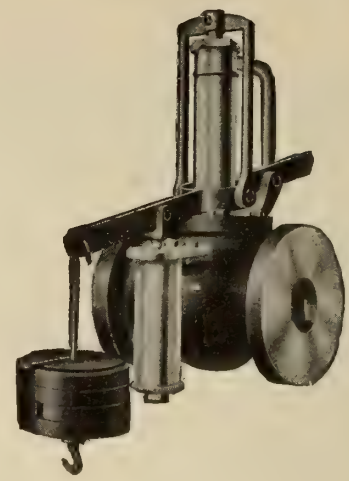

Put your problems in pressure regulation up to us—we can solve them successfully. For thirty-five years and more we have specialized in the manufacture of valves for this purpose. If our standard devices are not suitable for the service, we are equipped to make something special to meet the conditions.

Send for a catalogue of Davis Valves and let us know when you need anything in the valve specialty line.

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Established 1875
434 Milwaukee Avenue, Chicago
Manufacturers of Valve Specialties for the automatic regulation of pressure.

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VOLUME V

JANUARY TO DECEMBER, 1912

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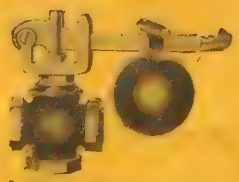

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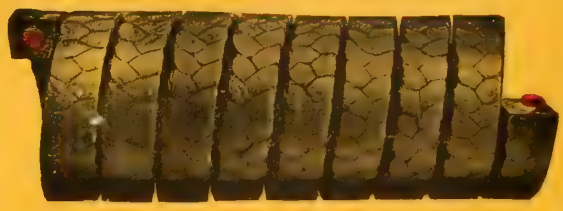

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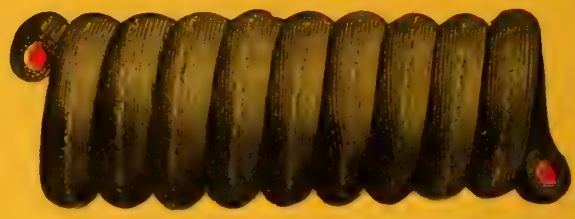

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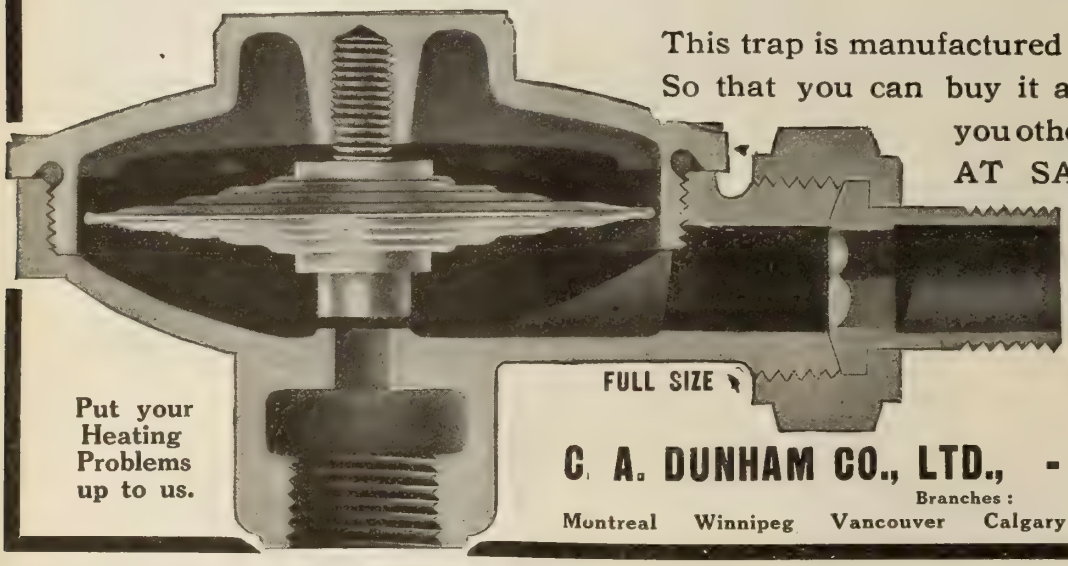

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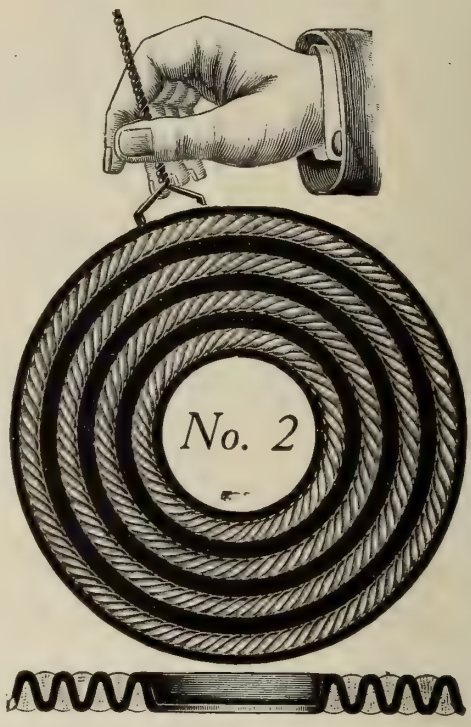

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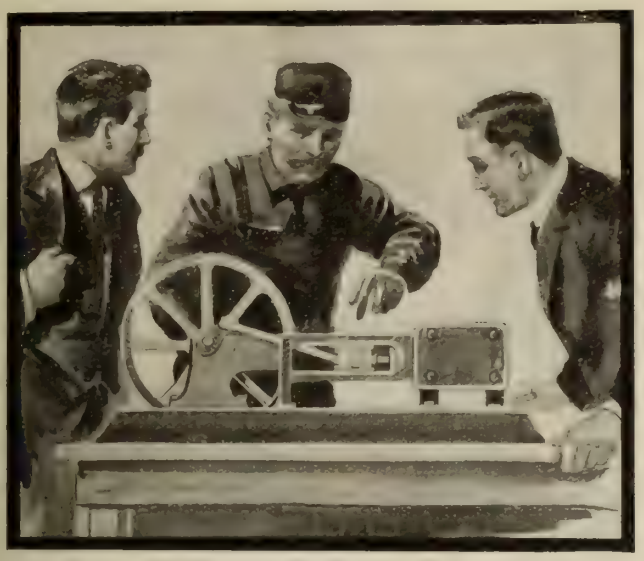
NEW BRUNSWICK, N.J.

QUAKER CITY RUBBER COMPANY | QUAKER CITY RUBBER COMPANY | QUAKER CITY RUBBER COMPANY



"Explain the Action of the Slide Valve"

Should you go before an Engineers' License Board, regardless of what else may be required of you, most certainly you will be asked to "explain the action of the slide valve." Can you do it, both theoretically and practically? That is, can you describe the working of all the modifications of the slide valve—lap, lead, etc.?

We've an illustrated book for you that clearly and simply explains practically every type of slide valve. It will be sent, FREE, if you comply with the easy conditions stated below.

Positively, no book will be sent, unless the coupon is fully filled out and returned to us.

How To Get The Valve Book Free

Fill out the Coupon, and mail it to us. We will address a book to you, and send it to your dealer, who will hand it to you, FREE of charge, when you call at his store and look at Daniel's P. P. P. Packing.

Your Name .....
Address .....
Employed by .....
Address .....
Horsepower of Engine .....
Kind of Rod Packing Used .....
Do you use EBONITE Sheet Packing? .....
Dealer's Name .....
Address .....
Name of Buyer .....Series 24B

If your dealer doesn't carry P. P. P. we will write telling you who does, and the book will be sent to the dealer we name. Please do not call for book until we notify you.

Use Your Fingers to Tighten the Gland

When you pack a stuffing-box with P.P.P., just use your fingers to tighten the gland nuts. Never use a wrench—it is unnecessary.

The "sliding wedges" and "compressible cushion" prevent practically *all friction* during over 75% of the piston travel, and reduce it to the minimum during the balance of the backward stroke.

Daniel's

P. P. P.

Rod Packing

A Bridgeport, Conn., chief engineer writes:

> "I have used P. P. P. on scored rods, and by **just using my fingers** to screw up the stuffing boxes they were made steam-tight and stayed so longer than with any other packing."

Order enough P.P.P. from your dealer to pack a single stuffing-box, one time—we will wager that you will use no other. Why not do this TO-DAY?

FREE to Users of P.P.P.

If you are a user of Daniel's P.P.P., fill out the coupon and mail it to us with the Big Red D—cut from the box lid—and a **testimonial letter** of your experience with the packing. We will mail you a FREE copy of "The Slide Valve" direct. You'll not be required to go to your dealer for the book. Don't forget the letter.

QUAKER CITY RUBBER COMPANY

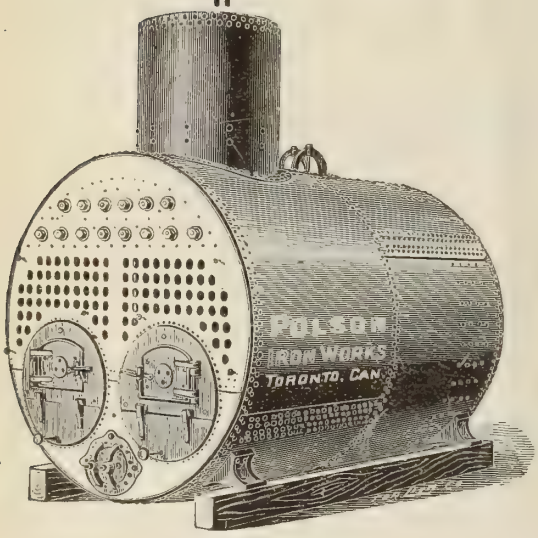
Manufacturers of Mechanical Rubber Goods
PHILADELPHIA, U.S.A.

MARINE BOILERS

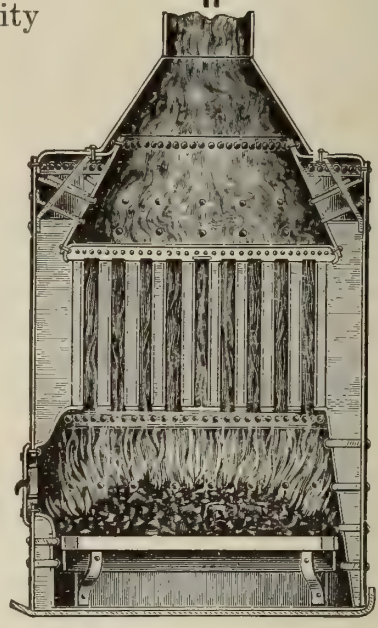
LAND BOILERS

The Utmost in Boiler Efficiency

From start to finish these boilers are under the supervision of experts, and are made by men with long experience. Only the best materials are used, so as to ensure a boiler of unusual durability and safety.



It will pay you to communicate with us and get full particulars. You may need a new boiler soon, and you will want the best.



We build various types:

Scotch, Clyde, Fitzgibbon, Vertical, Mosher.

Horizontal Tubular, Vertical, Locomotive Type, "Heine" Water Tube

GENERAL PLATE WORK

POLSON IRON WORKS, LIMITED

STEEL SHIPBUILDERS, ENGINEERS AND BOILERMAKERS

TORONTO **CANADA**

REPRESENTATIVES IN CANADA FOR

The B. F. Sturtevant Co., Hyde Park, Mass., U.S.A., Fans, Blowers, Heating and Ventilating
The John I. Thornycroft Co., London, England, Marine Motors

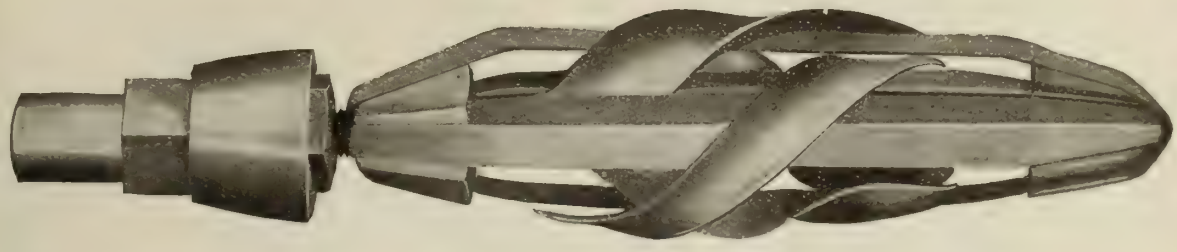
The advertiser would like to know where you saw his advertisement—tell him.

Why is it Most Flue Cleaners Run so Hard?

Because the rub is almost Square Across the Flue.

This one big objection has been entirely removed in the construction of

The Garlock Common Sense Flue Cleaner



This cleaner has a long shearing cut, making it the easiest running cleaner on the market to-day.

It **shaves** the carbon off, cleaning the flue **perfectly.**

It is adjustable to wear, because the wear comes on the cutters, **not** on the frame, never sticks in a flue, passes all welds or collapses, and can be easily sharpened by passing a file over the knives.

Most cleaners fail to get the flue clean, because they only **rub** the carbon **baked** on the flue and it **cannot be rubbed off.**

Garlock Common Sense shaves clean every time. This reason and because the temper in the material of the Common Sense will stand cleaning **hot** flues commends it to **Every Engineer.**

Write for literature and price lists.

The Garlock Packing Company

Head Office and Works: HAMILTON, ONT.

Branches :

WINNIPEG
181 Market St. E.

TORONTO
77 Adelaide St. E.

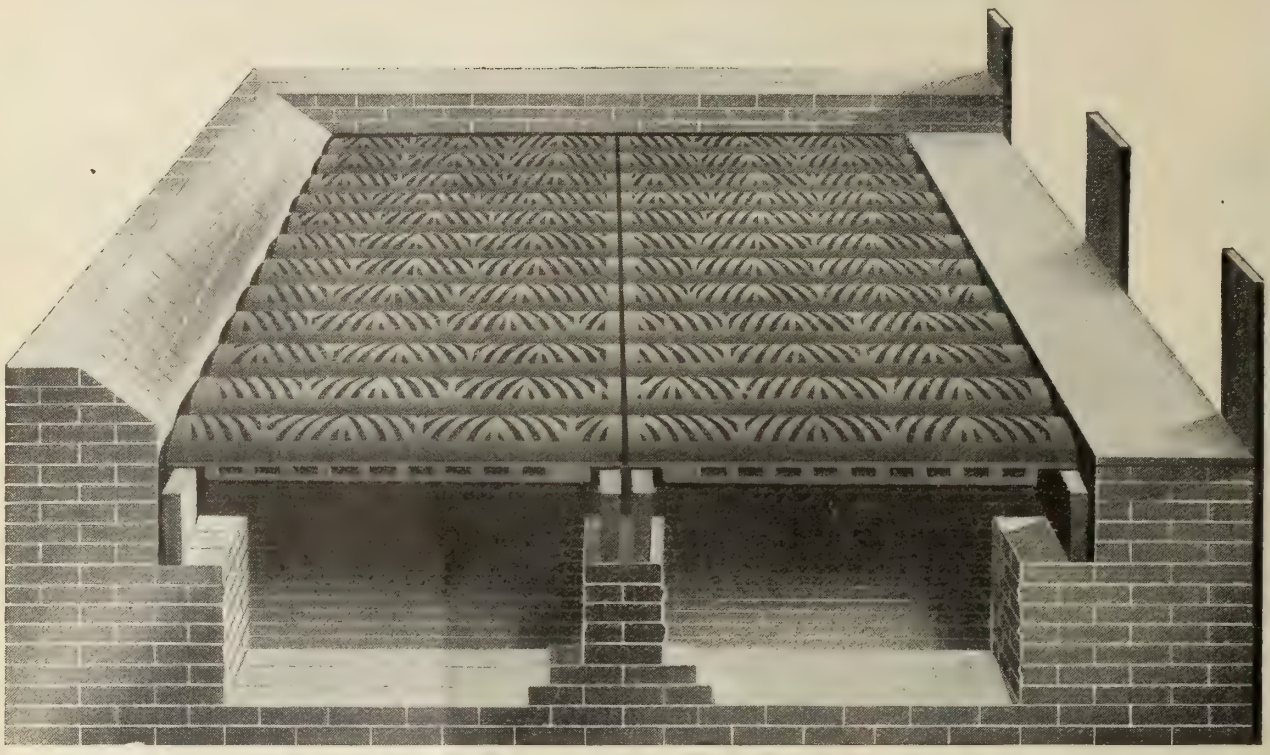
MONTREAL
412 St. James St.

"PIONEERS IN THE PACKING BUSINESS."

THOMAS ELLIPTIC GRATE BARS

SHAKING—CIRCLE—STATIONARY

FOR EVERY FUEL



THOMAS IDEAS

PATENTED

THOMAS ELLIPTIC GRATE BARS	INCREASE STEAM—SAVE FUEL—SAVE LABOR —COST LESS—REDUCE SMOKE.
THOMAS GRATE RESTS	EVERLASTING—PRESERVE GRATE BARS—PROTECT FIRE WALLS.
THOMAS FURNACE SETTING	FIRE WALLS—BRIDGE WALL—FRONT WALL independent of all expanding and contracting irons. SEE THAT AIR SPACE COMPLETELY ENCIRCLING THE GRATE AREA. No dead and burned grate bar ends. No pushed down walls from expansion of grates.

Shipped from Hamilton, Ont. **Let us give you complete information.**

FOR ALL PROBLEMS

Steam—Grate Bar—Furnace—write THOMAS

The General Supply Co. of Canada, Ltd.

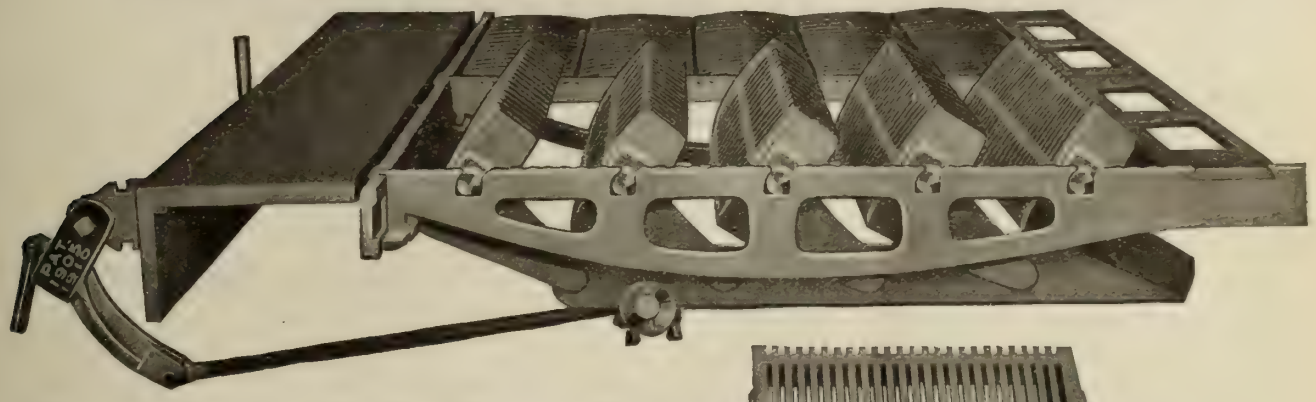
OTTAWA TORONTO WINNIPEG

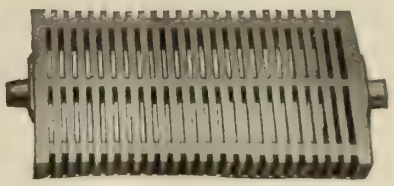
THOMAS GRATE BAR CO., **Birmingham, Ala., U.S.A.**

"THE Cyclone"

Shaking and Dumping Grate Bar

Will Save You Many Dollars Annually In Fuel





Permits The Use Of The Cheapest Grades Of Fuel With Results Equal To That Of The Best.

The **"Cyclone"** is even recognized as the best by a few of our competitors by the fact that they are trying to imitate it. Beware of imitations—their quality is inferior. Get the genuine.

The "Cyclone" has an improved mechanism, which means more vigorous and effective shaking and prevents any ashes or clinkers from clinging to the centre of the grate

The **"Cyclone"** is the one that locks level, cannot get out of adjustment or become warped. It allows 68% air space and 90% draft and gives a perfect combustion.

Burns cheap fuels, such as soft and hard coal screenings, coke breeze, hard and run of mine coal.

Contemplating installing a new grate?—if so get in touch with us. We absolutely guarantee satisfaction.

CANADIAN STEAM BOILER EQUIPMENT COMPANY, Ltd.

SOLE MANUFACTURERS FOR CANADA

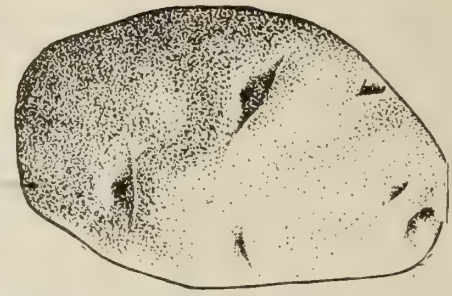
211 QUEEN STREET EAST :-: :-: :-: **TORONTO, CANADA**

AGENTS

ST. JOHN, N.B., F. W. Blizard, Canada Permanent Chambers. MONTREAL, H. L. Peiler & Co., 308 St. James Street.
HAMILTON, Robt. Fitzsimmons, 8 Grove Street. CALGARY, Alta., The Western Foundry & Metal Co., Limited.
BERLIN, J. Hainsworth, 14 Foundry Street. WINNIPEG, Vulcan Iron Works.

You Will Have Scale-Free Boilers

IF YOU USE

POTATO  SCALE

BOILER CLEANSER

"A Remover and Preventative of Scale That is Absolutely Harmless To Tubes Or Fittings"

Why continue to let **scale** eat up your profits when at a **very little** cost you can completely eradicate it and prevent any new scale from forming.

We do not back this boiler cleanser with claims—we back it with a **guarantee of satisfaction or no pay.**

We take great care in the preparation of this compound so that **no** injurious substances are used.

Send us a gallon of feed water and we will mix a quantity for **free trial** to suit your feed water conditions.

Get in touch with us NOW.

Our Numidian Cylinder
Velox Engine and
Sliptivity Machine
OILS
FORM A TRIPLE COMBINATION THAT IS HARD TO BEAT

C. C. SNOWDON

Refiner, Importer and Manufacturer of

Pennsylvania Lubricating and Refined Oils, Gasoline, Potato Scale Powder, Liquid Soap, Disinfectants, Polish, Waste, Oil Tanks, Etc.

1810-1840 11th STREET EAST, CALGARY, ALBERTA

P. O. Box 1384

The advertiser would like to know where you saw his advertisement—tell him.

Perolin

The Boiler Metal Preservative.
Solves the Scale Problem.

¶ **PEROLIN treats the metal only.** Does not affect the water, nor is it affected by the water. Removes scale of any thickness, and prevents new scale forming. Works upon a well-known scientific principle.

¶ Successfully used throughout European Countries for a number of years. Made here under the same formula, with the same results.

¶ Positively stops Pitting, Corroding, Foaming. Preserves the boiler metal in its original condition.

¶ **Boiler Metal** is universally the same. **Water** in every locality is constantly changing.

¶ Any preparation powerful enough to Dissolve Scale must in time injure the boiler metal, tubes, packing, gaskets.

¶ **PEROLIN** has no **chemical** action—but separates the incrustation from the metal **mechanically.**

Try it at our expense.

Over 6,500 satisfied users in this country secured within two years upon the same terms.

DOMINION SPECIALTIES LIMITED

44 Adelaide Street West - - TORONTO, ONT.

TRADE JENKINS MARK
Jenkins Bros

Here's a Catalog

You Ought to have—

The new Jenkins Bros. Catalog for 1912

It shows some new types of valves, including the new TYPE "K" brass and iron body gate valves; cast steel valves of extra heavy patterns for superheated steam and hydraulic service, extra heavy check and blow-off valves, automatic equalizing stop and check valves, additional styles of radiator valves—

As well as the standard Jenkins Bros. types you have known and used for years.

Compact—handy—brimful of information for the man who's interested in valves, packing and other mechanical rubber goods for the power plant.

Send for your copy to-day.

Jenkins Bros., Limited

103 ST. REMI STREET

MONTREAL

HOISTING ENGINES

Dust and grit and uneven strain and exposure, combine to make the wear and tear on the bearings of Hoisting Engines very severe. The following letters indicate that Magnolia Metal is well suited for that service.

April 6th, 1911.

Gentlemen:—

I have used your Magnolia Anti-Friction Metal on *hoisting* engines of the following makes, Ligerwood, Mundy, Lambert, Mead, Morrison, Dela Vergne and National, and think that *it can't be beat.* I have run these engines *three years without re-babbitting the shafts* and those contracting firms certainly work these engines for all they are worth. Sometimes they start in at six in the morning and work until six at night.

Yours respectfully,
Leonard J. Hill,
160 Eagle Street,
Brooklyn, N.Y.

Chicago, Ill., 4-21-11.

Gentlemen:—

I have used considerable of your babbit metal and have found it very valuable. I have followed Hoisting and Portable work exclusively. It is a well known fact that engines of this type receive a great deal more use than Stationary engines do, because we move quite often, and in most cases our engines are exposed to all kinds of weather conditions, and all our boxes are exposed to sand, cement, stone, dust and all other kinds of matter, and I have found that Magnolia Metal has always given the best results. I am representing the Street Paving Engineers of Chicago and vicinity, branch of local 69, International Union of Steam Engineers, and I personally know that most of our members use your Babbitt Metal, because it gives the best results.

Faithfully yours,
Matt Keefe,
820 W. 57th St.

SPECIAL OFFER

PRACTICAL ENGINEER POCKET BOOK—700 pages, over 2,000 subjects: Price 40c post paid. We do not aim to make a profit on these books: We buy them in large quantities as an advertising medium and give Engineers benefit of low price. They are highly spoken of by Engineers. Address Montreal Office.

SOLD BY LEADING DEALERS EVERYWHERE OR BY

MAGNOLIA METAL CO.

OFFICE AND FACTORY:

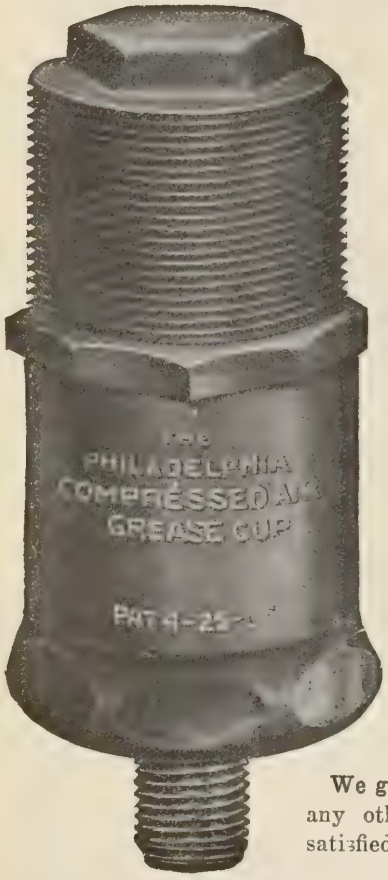
225 St. Ambroise St., - MONTREAL

The advertiser would like to know where you saw his advertisement—tell him.

SAVE 50%

By Using
GREASE AS A LUBRICANT
In The

"PHILADELPHIA" GREASE CUP



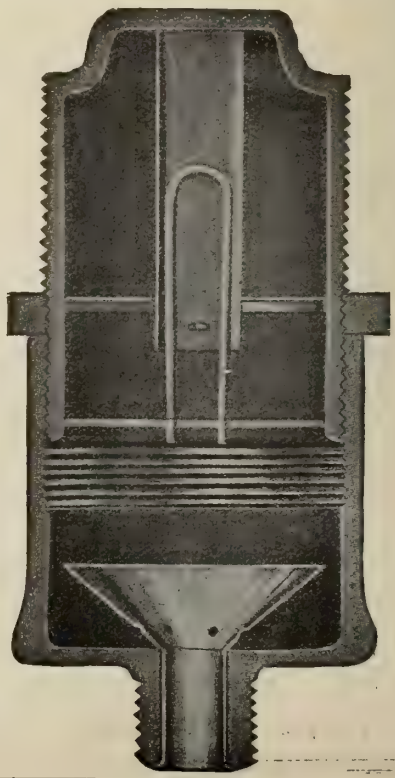
Automatic Feed Under Compressed Air
Slow And Continuous
No Oil Drips—Reduced Fire Hazard

Unexcelled for Lubricating Loose Pulleys, Crank Pins and all classes of Extremely High Speed and Heavy Running Machinery.

In the "Philadelphia" Grease Cup System of lubricating there is no friction, no piston or spring is used, just a thin metal disc resting lightly on the grease to keep it level.

Air pressure above and the needs of the journal below are all that is required to give perfect lubrication. Grease does not change in the slightest, while in the **"Philadelphia" Cup**; the last drop is as good as the first.

There is a large unrestricted outlet and a regularity of action which permits feeding of grease of any thickness.

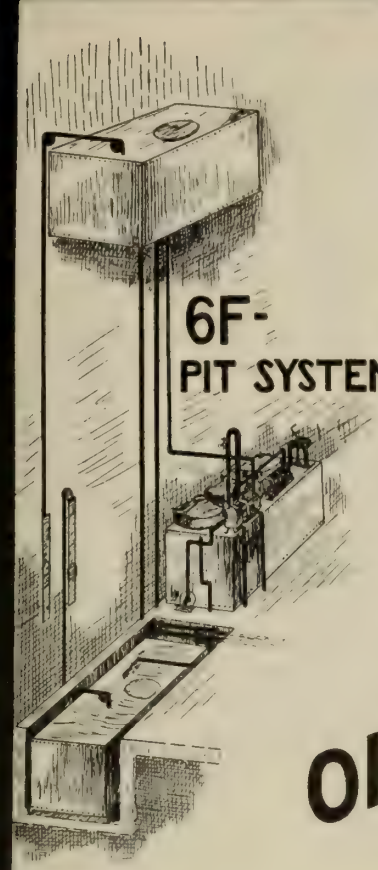


We guarantee a saving of at least 50% over any other system. You must be perfectly satisfied before you pay a cent.

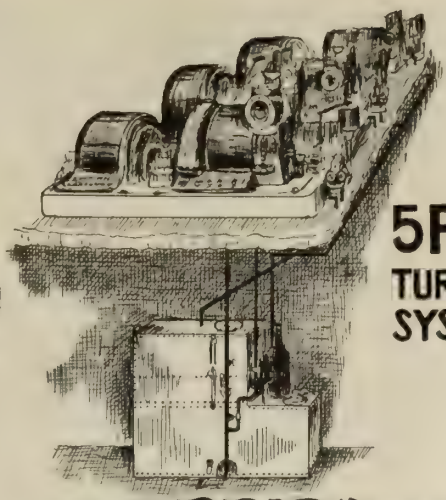
Our Booklet tells more about it — write to-day.

Peterborough Lubricator Mfg. Co., Limited

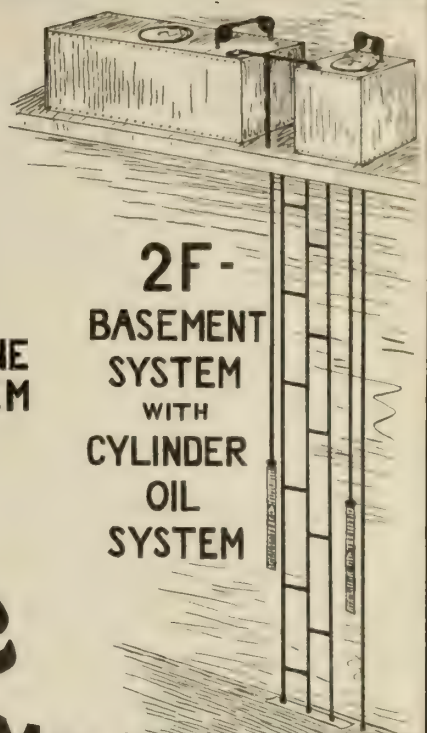
PETERBOROUGH, ONTARIO



6F-
PIT SYSTEM

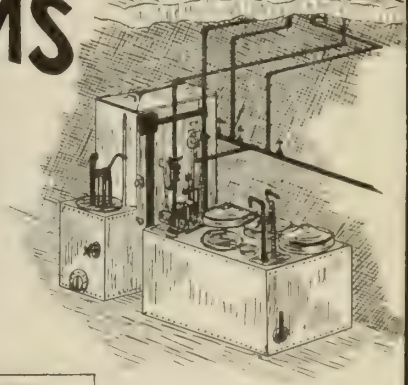


5F-
TURBINE
SYSTEM

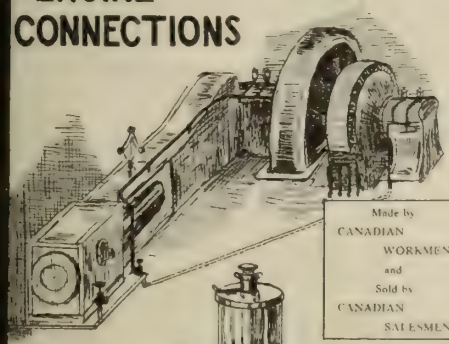


2F-
BASEMENT
SYSTEM
WITH
CYLINDER
OIL
SYSTEM

BOWSER
OILING-SYSTEMS



ENGINE
CONNECTIONS

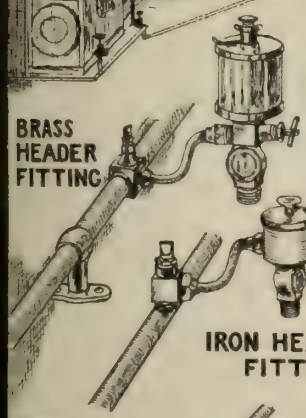


Write for Illustrated Descriptive Book, entitled
"Factory and Railroad Oil Storage"
Mailed FREE upon Request.

Made by
CANADIAN
WORKMEN
and
Sold by
CANADIAN
SALESMEN

S. F. Bowser & Co., Inc.
84-85 Frazer Ave., Toronto, Ont., Canada.
ESTABLISHED 1885
Patentees and Manufacturers of Standard, Self-measuring, Hand and Power-Driven Pumps, Large and Small Tanks, Gasolene and Oil Storage and Distributing Systems, Oil Filtration and Circulating Systems, Dry Cleaner's Systems, Etc

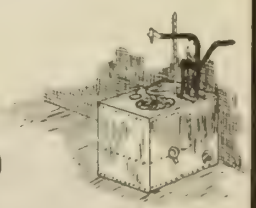
BRANCHES
LONDON
12 Victoria St., S. W.
PARIS
8 Rue Denis Poisson
JOHANNESBURG
PORTO RICO
BUENOS AIRES
MEXICO CITY
HAVANA



BRASS
HEADER
FITTING

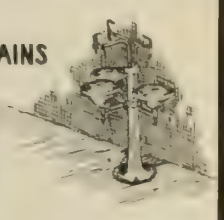
BULLS
EYE
CUPS

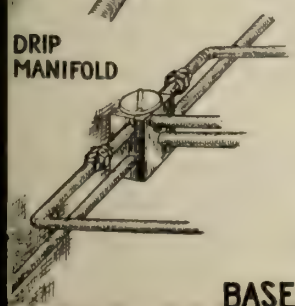
IRON HEADER
FITTING



5F-HAND
FILTER

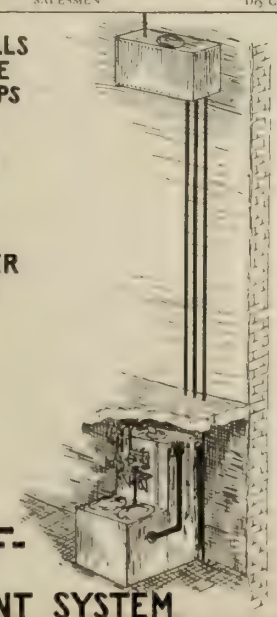
23F-OIL FOUNTAINS



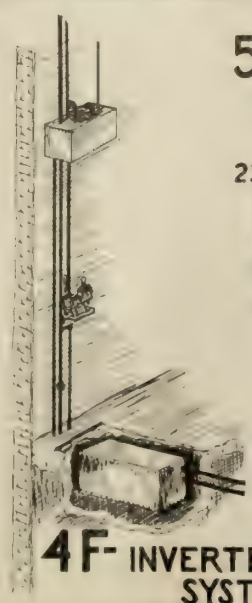


DRIP
MANIFOLD

OIL
COOLER
AND
HEATER



3F-
BASEMENT SYSTEM



4F-INVERTED
SYSTEM

HOT
BARREL-SUCTION

The advertiser would like to know where you saw his advertisement—tell him.

THE TRIPLEX BLOCK

A Book of the World's Best Practice

WHY shouldn't a workman who handles coal or steel have just as great an output per hour as a man who handles cork? Hundreds of industries are using hoisting machines, and conveying apparatus in connection therewith so efficiently that workmen scarcely realize that the loads they are lifting and moving single handed, thousands of pounds every hour of the day, are more than trifling loads of a few score pounds.

The New Book of Hoists

shows such plants in operation and gives tables of efficiency which will help to solve your manufacturing problems. Send for a copy to-day. To-morrow you may be too busy to think of it.

Triplex Blocks 16 Sizes: One-fourth of a ton to forty tons. 300 Active Stocks all over the United States and Canada.

Every Block Tested to Fifty Per Cent. Overload.

THE CANADIAN - FAIRBANKS - MORSE CO., LIMITED

444 St. James Street **MONTREAL, CANADA**

BRONZE TO BRONZE
AT THE JOINT

The DART Union

CANNOT LEAK, Rust or Corrode

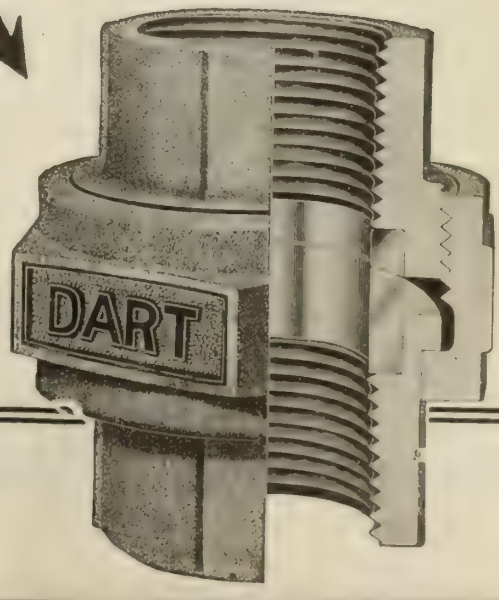
Makes Joints Easily and Quickly Whether Pipes are in or out of Line.

Never Needs to be Replaced.

Can be Connected and Disconnected Time after Time without Impairing its Efficiency.

If You should ever find a Defective "DART" UNION we will give you two new ones for it.

All Convenient Types Handled by Your Jobber.



Dart Union Co., Limited

TORONTO, CANADA

The advertiser would like to know where you saw his advertisement—tell him.

Use Stephenson Bar Belt Dressing

Make 1913 a record breaking year. Turn over a new leaf and get rid of the things that have been causing needless trouble and expense. Adopt the things which will make your work easier, give better results and save money for your employer. You cannot start at a better place than with your belt dressing.

Get rid of your troublesome liquid dressing. Shake the can for the Stephenson solid stick and shake trouble at the same time.

Stephenson Bar Belt Dressing is a friend in need. It doesn't require preparation, nor do you have to use special care in applying it. The minute the belt slips you hold the Stephenson bar to the belt for a few seconds and the slipping stops. There's no waste—no slop—no smearing on of paste or pouring on of spattering liquid. And the results are better.

I'll "**Stick to the Solid Stick**"

Start With a Free ½ Lb. Sample

Simply send us your name and address and we'll send you a present in the shape of a free half-pound sample of Stephenson Bar Belt Dressing.

Remember—we give you this sample absolutely free of charge. Get this free half-pound of the finest belt dressing made and test it. Here's your chance to try somesomething really good at no expense.

None Genuine Without Trade-Mark

Stephenson Manufacturing Company

Est. 1888 **Albany, N.Y.** **Inc. 1897**

The advertiser would like to know where you saw his advertisement—tell him.

IT'S JUST LIKE THROWING MONEY AWAY

To Use an Inefficient and Unreliable BELT

STOP IT!

You Can SAVE MONEY By Using

D. K. McLaren's Genuine British OAK TANNED Leather Belting

Made from the choicest centres of the hides, which are tanned by our secret Genuine British Oak Tanned Process.

Manufactured under our personal supervision and guaranteed to give long, economical service.

D. K. McLAREN'S Belting is thoroughly stretched before being placed on the market, eliminating the lost time which otherwise takes place before tightening.

We want you to get the users' verdict.

Write us for list of users—then write them—they will convince you that this Belting is far beyond comparison.

Write us at once—remember we can save you money.

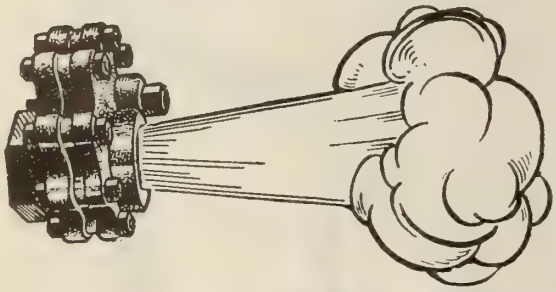
D. K. McLaren, Limited

Montreal 351 St. James St. **Toronto** 200 King St. W. **Vancouver** 37 Alexander St. **Quebec** 21 St. Peter St. **St. John, N.B.** 64 Prince William St.

The advertiser would like to know where you saw his advertisement—tell him.

INVESTIGATION
OF "EVERLASTING" BLOW-OFF VALVES
Will Prove Many Facts

IT NEVER LEAKS!



MADE IN MANY TYPES FOR

Stationary
Locomotive
Marine
Ammonia
Gas and Air

WHY NOT INVESTIGATE?

SOLD AND MANUFACTURED UNDER CANADIAN PATENTS BY

Engineering Specialties Company, 1080 King St., West, TORONTO

AGENTS

MONTREAL, QUE.
H. L. Peiler & Co.

ST. JOHN, N.B.
The A. R. Williams Mach. Co.

WINNIPEG, MAN.
The A. R. Williams Mach. Co.

CALGARY, ALTA.
P. D. McLaren Limited

VANCOUVER, B.C.
Taylor-Forbes Company, Limited

Don't gamble on lubricators

TRADE MARK

A lubricator represents a mighty small investment compared with the cost of the machine with which it is installed, but the biggest and best engine in the world is absolutely dependent upon its lubrication.

Lack of proper lubrication means increased friction and increased friction means loss of power, bigger fuel bills and more wear and tear on the engine. Poor lubrication may result in an injured engine, expensive repairs or a complete shut down at a most inconvenient time.

It doesn't pay to take chances with your lubrication because there is too much at stake.

Detroit Lubricators are designed and made to eliminate every element of chance or uncertainty from the lubrication of any kind of machine.

Over two-thirds of the lubricators in the world are Detroits and wherever a Detroit Lubricator has been used the name Detroit has come to stand for sureness and dependability.

Every Detroit Lubricator embodies all the improvements and refinements made possible by long experience in the sale and manufacture of lubricators and by careful study of over 1,250,000 lubricators in use on all kinds of engines all over the world.

Write to-day for catalog G-58 which tells all about lubricators and lubrication.

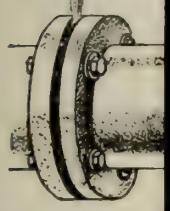
CANADIAN DETROIT LUBRICATOR COMPANY, LTD.

WALKERVILLE, ONTARIO

Largest Manufacturers of Lubricating Devices in the World.

The advertiser would like to know where you saw his advertisement—tell him.

Try it on the Worst Joint in Your Plant At Our Expense



HOW much time have you wasted following up packing, especially in those hard-to-get-at places? How many times have you had trouble on account of packing blowing, squeezing or burning out? Think what J-M Permanite Packing, with none of these shortcomings, would mean to you.

J-M Permanite is made differently from other packing. It isn't rubber. Yet it possesses the two features which are the only excuse for the existence of rubber packing—resiliency and pliability.

J-M Permanite Sheet Packing

has heat and pressure-resisting qualities because made of the finest grade of long-fibred Asbestos. It will make tight joints under all conditions. It adjusts itself to any joint.

Being one of the lightest packings made, its price, comparatively, is very low, which makes it the most economical packing to use.

All these features make J-M Permanite splendidly adapted for superheated and high pressure service, as well as for low pressures in cylinders and steam chests, and for ammonia lines, acids, alkali and sugar solutions.

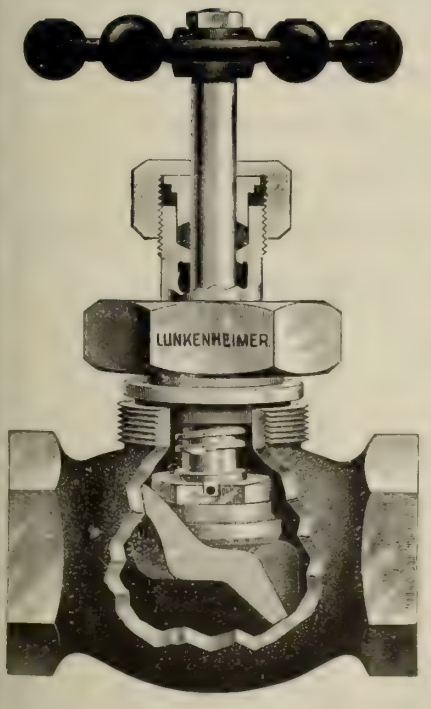
We'll send you, without charge, enough of this packing to try in the one place in your plant **where no other packing has ever made good.**

WRITE NEAREST BRANCH FOR SAMPLE AND CATALOGUE.

THE CANADIAN H. W. JOHNS-MANVILLE CO., LIMITED

Manufacturers of Asbestos and Magnesia Products — TRADE ASBESTOS MARK — **Asbestos Roofings, Packings, Electrical Supplies, Etc.**

TORONTO MONTREAL WINNIPEG 1372 **VANCOUVER**



LUNKENHEIMER REGRINDING VALVES

These valves have invariably maintained a reputation for quality of the very highest, and justly so, because they are **absolutely dependable**, are made of the **best grade** of **only new material**, and by **skilled mechanics**, in the shops of **The Lunkenheimer Company**, whose reputation for quality is universally acknowledged.

They require no extra parts when the seating faces are worn. They can easily and quickly be reground, making them as tight as when new, and this process does not necessitate the removal of the valves from their connecting pipes.

The union connection between the body and hub permits the valve to be quickly and easily taken apart for regrinding or repairs, and also protects the uniting threads from the corroding action of the steam.

LUNKENHEIMER REGRINDING VALVES can be packed under pressure when wide open, and the areas throughout the bodies are largely in excess of the nominal diameter of the connecting pipes.

The valves are made in two styles—one with **Inside Screw** and the other with **Outside Screw and Yoke**, and in two weights—**Medium Pattern**, for working pressures up to 200, and Extra Heavy for pressures up to 300 pounds.

Your local dealer can furnish them. If not, write us.

Write for catalogue.

THE LUNKENHEIMER COMPANY

3-43

Largest Manufacturers of High-Grade Engineering Specialties in the World.
General Offices and Works: CINCINNATI, OHIO, U. S. A.

NEW YORK, 64-68 Fulton St. — **CHICAGO,** 186 N. Dearborn St. — **BOSTON,** 138 High St. — **LONDON, S.E.,** 35 Great Dover St.

The advertiser would like to know where you saw his advertisement—tell him.

Dearborn Scientific Treatment for Boiler Feed Water Troubles

Scale on the boiler tubes or sheets acts as an *insulation* — it increases your fuel expense and decreases your available power. "Ready made" compounds do not solve the problem.

Scale forming minerals are of many varieties, and the only way to overcome *priming, foaming, pitting, bagging* and similar feed water troubles, is to determine with accuracy what minerals are present, and then compound the remedy to order, as conditions are rarely identical.

Our experience in treating boiler feed waters is world-wide. Our Laboratory Equipment and staff of expert analysts are the largest and best ever devoted exclusively to feed water problems. Our unequalled success is attested by thousands of power plant operators.

Dearborn Service will be profitable to you. Send samples of your boiler feed water for analysis.

DEARBORN CHEMICAL COMPANY

McCORMICK BUILDING CHICAGO

Paying Dividends through the Boiler Room

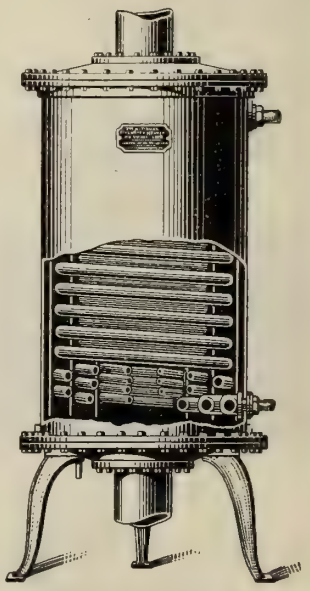
The decreased cost of production which inevitably follows a saving in fuel and an increase in boiler capacity is secured by the

NATIONAL
FEED WATER HEATER

It feeds pure clean water, for the water heated by exhaust steam which surrounds the tubing, is free from grease and grit.

It is economical because it uses exhaust steam which otherwise might be thrown away.

It is both safe and durable, for the shell is not under pressure—it never corrodes, for it is not in contact with exhaust steam; the coils are guaranteed to stand 600 pounds per square inch and the feed water has no action on copper and brass.



The National Pipe Bending Company

91 Lloyd St., New Haven, Conn.

Makers of Pipe Coils and Bends of every description—for All Purposes—Iron, Brass, Copper.

Ask for Catalog No. 1

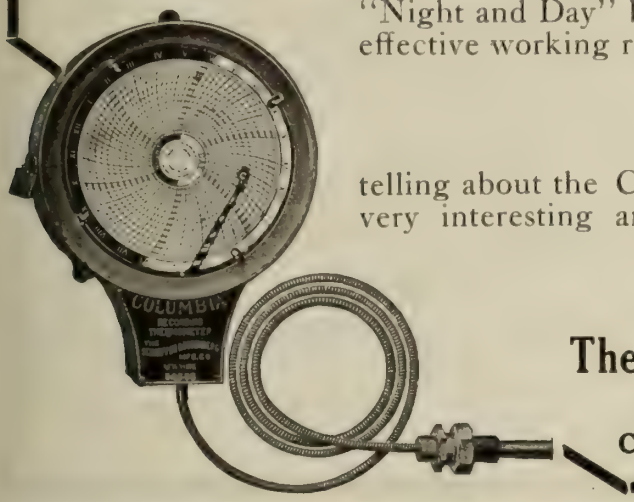
The advertiser would like to know where you saw his advertisement—tell him.

The "Columbia" Recording Thermometer
Is Mercury Actuated

And Mercury, you know is the best substance in existence for measuring temperature. Therefore, the records given by the Columbia are accurate at all times, naturally.

To combine extreme strength with accuracy, the entire working mechanism of the Columbia is made of steel, meaning long life.

Other features are the non-spilling, non-corrosive glass recording pens and the popular "Night and Day" border charts with uniform graduations and wide effective working range.



Our Catalog

telling about the Columbia Recording Thermometer and its uses is very interesting and instructive. A copy awaits your request.

Ask for Catalog W-28.

The Schaeffer & Budenberg Mfg. Co.

BROOKLYN, N.Y.

Chicago Pittsburgh

Shell is Cast in One Piece of Cast Iron and is not Subject to Pitting or Corrosion

The "SIMS"
Open Feed Water Heater Filter and Purifier

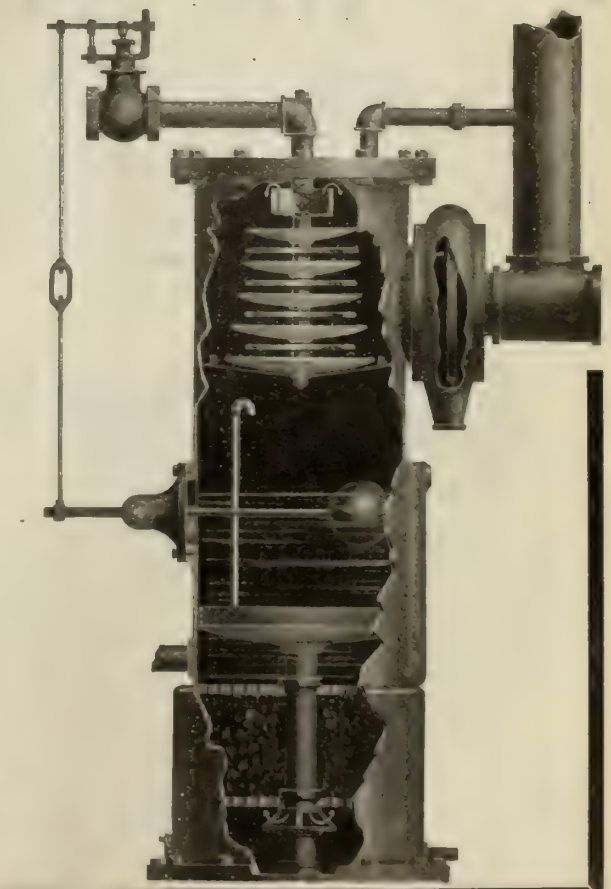
Saves 15% of fuel. Also saves water to the extent of the exhaust steam condensed in heating the feed water.

An even water level is maintained by an automatic inlet valve, controlled by a ball float, and perfect distribution of water in the steam chamber is obtained by passing it over a series of trays or saucers, giving the effect of a shower.

FILTERING UPWARD through a bed of COKE is obtained by conducting the water to the bottom or Mud Chamber of the heater, where the heavier impurities settle by gravity, thence upward through the filter to the pump suction. Opening the Blow-off valve not only cleans out the mud chamber, but thoroughly flushes the Filter bed, keeping it in a high state of efficiency.

Sizes built—50 H.P. to 2,500 H.P., with or without By-Pass Cut Out Valve.

Write for complete details.



THE SIMS COMPANY, Erie, Pa.

CANADIAN REPRESENTATIVES:

H. L. Peiler & Co., 380 St. James Street, Montreal, Que., and 84 Church Street, Toronto, Ont.

FULTON WATER-COOLED MECHANICAL STOKER

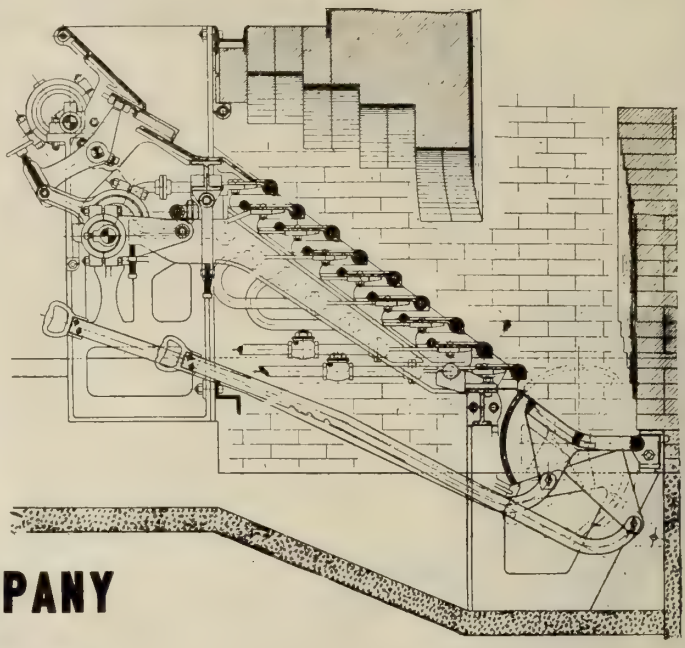
It is Water Cooled.

Repairs Almost Eliminated.

Natural Draft only, but 100% overload easily secured.

Smokeless, in Operation 70-78% Efficiency Obtainable.

Write for Further Particulars.



THE
HARE ENGINEERING COMPANY
Limited

14-16 King Street East **TORONTO, ONT.**

THE VULCAN IMPS

I SAVE LABOR
SO DO I
I CLEAN TUBES EVERY FEW HOURS
I CLEAN TUBES 100%
I INCREASE BOILER CAPACITY
I LIKE TO PLAY WITH MY COMPETITORS
I BLOW WITH THE DRAFT
I SAVE HOSE

"And We All Save Coal"

Wherever the **VULCAN SOOT CLEANER IMPS** are allowed to work they raise the Devil—the Soot Devil. They juggle the heat units and make two units grow where one unit grew before. They make slow steaming boilers "pop" for the first time in years. They give many a weary engineer and fireman a chance to rest. The IMPS are always on the job, "they work while you sleep." They cut out lost time, trouble and repairs. They are good for the operating man and mighty good for the boiler owner. Don't let Soot, the expense maker, worry you longer. Fill out the coupon, mail it now, and we'll send you our Free Booklet, "Economical Steam Production," which shows how the Vulcan removes Soot, and saves from 5 to 15% in fuel.

Mail the Coupon

Vulcan Tube Cleaning Systems,
LIMITED
42 Craig St. West **MONTREAL**

SIGN, TEAR OUT AND MAIL

P.H. 10-12. Date.....

VULCAN TUBE CLEANING SYSTEMS, LIMITED, Montreal.

Please send me, without charge, your book—ECONOMICAL STEAM PRODUCTION, and your proposition.

(It is important that following information be given in full.)

WATER TUBE BOILERS. Number.....Type.....
Pressure .....Horsepower .....No. Tubes H
(except on Stirling boiler .....Any Superheaters .....Width of alley space at side .....
TUBULAR BOILERS. Number.....Horizontal or Vertical .....
Name .....
Address .....

The advertiser would like to know where you saw his advertisement—tell him.

THERE MUST BE A REASON

FOR REPEAT ORDERS

For Murphy Automatic Smokeless Furnaces

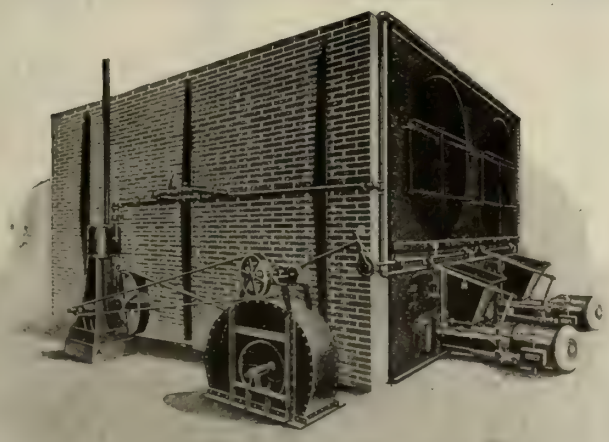
THE HARRIS ABATTOIR CO., Ltd., Toronto, Ont., has had three years' experience with Murphy Furnaces :

1st order	Aug. 1909	. . .	1 furnace, 250 H.P.
2nd "	Oct. 1909	. . . .	2 furnaces, 500 H.P.
3rd "	Dec. 1912	. . .	3 furnaces, 900 H.P.

This last contract is for equipment for their new abattoir.

Write to-day for Catalogue

MURPHY IRON WORKS, DETROIT, MICH. BUFFALO, N. Y.



STOP

AND

CONSIDER

THE JONES

Have you ever realized what it means to have the fuel and air supply in your steam plant proportioned and regulated by steam pressure carried? We wish to emphasize this feature of the "Jones" Underfeed System as strongly as possible because of the fact that it nearer approaches perfection than has ever been obtained by any method of firing.

In reality it means (within reasonable limits) that it is not possible for a fireman to use a greater quantity of coal than is necessary to carry the load. There is no guess work about it. Is not this feature alone worthy of most careful consideration?

It is a well known fact that in hand firing the fuel burned depends largely upon the skill of the fireman. No matter how good a fireman you may have you must realize that to a certain extent the amount of coal that he places in the furnace is based upon what he thinks is correct. The same condition exists with all other methods of mechanical stoking, as the control of the fuel supply is placed in his hands, but with our system the control is taken out of the hands of the fireman and is governed only by the actual requirements of the plan. The fuel being fed automatically and only when necessary, and the proper supply of air being automatically furnished at the same time, the result is the highest degree of economy and the entire abatement of the smoke nuisance. This of itself in many localities is a sufficient justification for an investment in "Jones" Stoker equipment.

Investigation of our claims will reveal many other features of manifest advantage, but the fundamental principle of the "Jones" Underfeed System, viz.: ability to deliver the right amount of air, to the right amount of fuel at the right time and place and while controlled by actual steam requirements only, puts into practice the recognized theoretical necessity for obtaining perfect combustion in the furnace, therefore the greatest economy in the cost of producing steam.

Does not this condition closely approach the ideal?

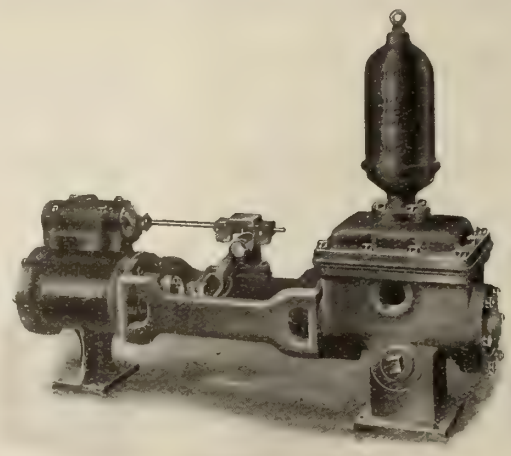
Jones Underfeed Stoker Co., Limited NATIONAL TRUST BUILDING TORONTO

The advertiser would like to know where you saw his advertisement—tell him.

BURNHAM STEAM PUMP

Of the thousands of steam pumps installed every year, a large percentage of them bear the name of "Burnham," the **Steam Pump** endorsed by leading Architects, Consulting Engineers and Heating Contractors as the best, simplest and most economical pump on the market.

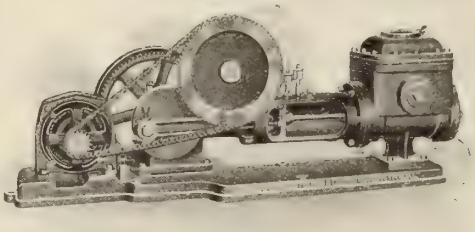
If you want a pump for handling hot water, use the "Burnham."



Burnham Boiler Feed Pump.

Thousands of Burnham pumps are in operation in connection with **Vacuum Heating Systems**; they are specially adapted for this service. Standard Burnham Boiler Feed Pumps and Burnham Vacuum Pumps are kept in stock and can be shipped promptly.

Ask for Catalogue "P."

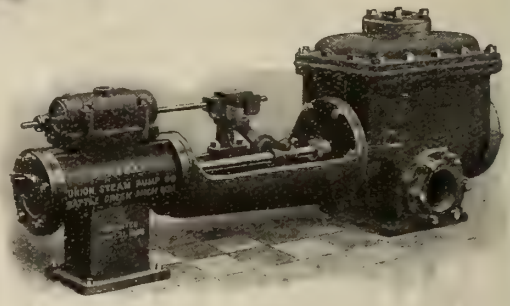


Union Electrically Driven Vacuum Pump.

Darling Brothers,
LIMITED

15 Ottawa St., Montreal.

Toronto, Winnipeg and St. John.



Burnham Vacuum Pump.

WALKER'S ELECTRIC BOILER COMPOUND

Will Increase Your Boiler's Efficiency

This compound quickly removes old scale, and if small quantities are used regularly, will keep your boiler tubes clean. Its composition renders injury to tubes or fittings impossible.
Try a small quantity at our expense.

WRITE TO-DAY.

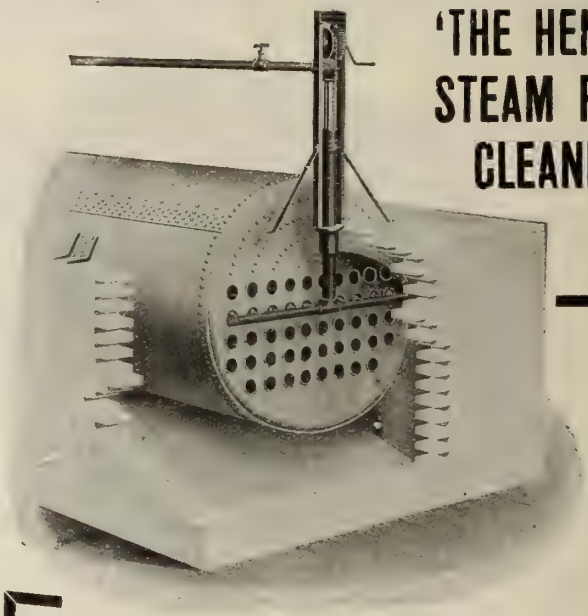
High Grade Oils

Regal Valve Oil	Vulcan Machine Oil
Red Star Cylinder Oil	Heavy Red Machine Oil
Monarch Cylinder Oil	Brush Dynamo Oil
Superior Engine Oil	Gas Engine Oil and all
Electric Engine Oil	Engine Supplies

The Electric Boiler Compound COMPANY, LIMITED

Guelph, - - Ontario

'THE HENRY' STEAM FLUE CLEANER



The Only Logical Way To Clean Flues

Will do its work while boiler is in actual use.
Saves Fuel, Saves Labor and Increases Boiler Efficiency.
Write for particulars.

THE STEAM APPLIANCE CO.

MILWAUKEE, WISCONSIN.

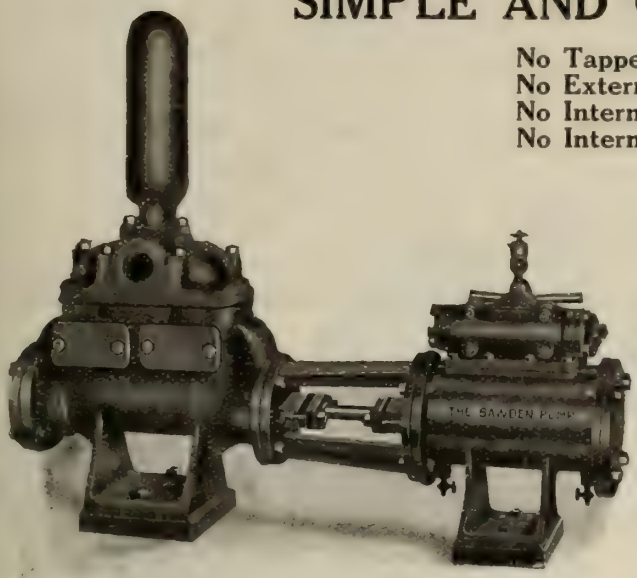
CANADA SALES CO., Donalda Bldg., Winnipeg

The advertiser would like to know where you saw his advertisement—tell him.

"BAWDEN" STEAM PUMPS

MANUFACTURED UNDER ATTWOOD'S PATENTS

SIMPLE AND COMPOUND, For all Purposes



No Tappets.
No External Valve Gear, Levers or Springs.
No Internal Tubes.
No Internal Stuffing Glands.

"Bawden" Pumps are governed by piston valves which are controlled by the action of live steam only.
—Simplicity throughout.
—Guaranteed to make full stroke under constant or varying loads.
—Valves, latest improved steam balanced type.
—Greatest economy of steam consumption.
The Bawden Pump provides the simplest, most economical and reliable means for feeding high or low pressure boilers.
Flexibility of speed obtained without any mechanical adjustment.
Automatic cushioning of piston and valves ensures greatest safety in any emergency.

THE BAWDEN MACHINE CO., Ltd., Toronto, Can.

Marsh Steam Pump

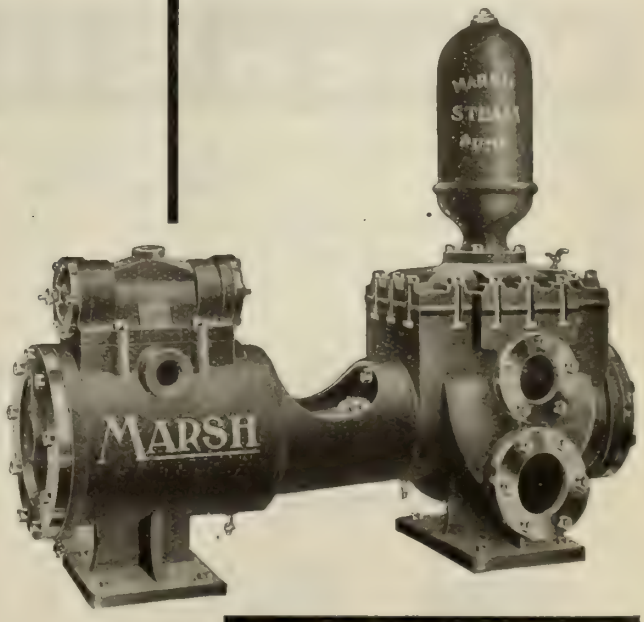
The Pump with the Self-governing Steam Valve

Note the extreme simplicity in construction and the absence of outside valve motion. There is practically nothing to get out of order. Nearly all the wearing parts are made of phosphor bronze instead of common brass, including piston rod, water cylinder lining and valve seats.

The steam valve is self-governing and admits only just enough steam to do the required work. The pump cannot short-stroke, race or pound under the most severe conditions.

115,000 in successful operation.

Ask for Catalog No. 18

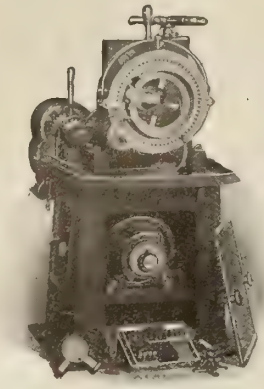


American Steam Pump Company

BATTLE CREEK - - - MICH.

CANADIAN AGENTS

A. R. Williams Machinery Co., Toronto
Williams & Wilson, Montreal
London Engines Supplies Co., London, Ont.
Stuart Machinery Co., Winnipeg
Hallman Machinery Co, Vancouver, B. C.
Mechanics' Supply Co., Quebec, Que.
Gorman, Clancey & Grindley, Limited
Edmonton & Calgary



The Peer of Pipe Cutting and Threading Machines

FORBES
MOTOR DRIVEN

In a class all by itself. Efficient—it cuts pipe and threads pipe with absolute accuracy. Economical—one man can do the work. The machine can be taken to the job. Power can be shut off when machine is not in use. It is the ideal machine for the modern plant.

Also Hand and Belt Driven

Write for Catalog

THE CURTIS & CURTIS CO. 26 GARDEN STREET BRIDGEPORT, CONN., U.S.A.

THE CANADIAN TURBINE WATER WHEEL — CONSERVE THE WATER POWERS — TRADE MARK.

Chas. Barber & Sons

Meaford : Ontario

WATER POWER EQUIPMENT ONLY

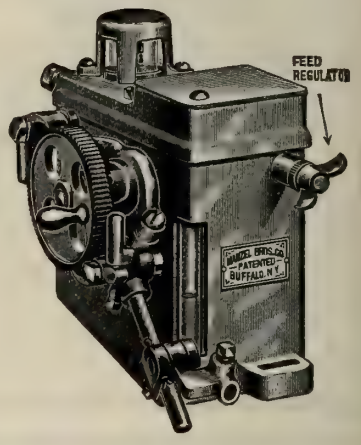
Write for Catalogue

Let Us Send You a "MANZEL" AUTOMATIC FORCE & SIGHT FEED OIL PUMP

On the condition that if it does not show a saving of 50 per cent. in oil over that of any hydrostatic lubricator after a 30 days' free trial you can return it at our expense.

The Manzel Oil Pump will feed the oil into the cylinder regularly and positively all the time—no matter how slow the engine runs, what pressure of steam is carried, how high or low the temperature.

Take advantage of this free trial offer at once. Remember there is no charge if not as we claim.



THE TWIN CITY OIL COMPANY, General Agents for Canada
BERLIN, ONTARIO

MANZEL BROTHERS COMPANY, - - BUFFALO, N.Y.

When All Others Fail

GERMAN VALVE CYLINDER OIL,
GERMAN ENGINE OIL,
STERLING FAST ENGINE AND DYNAMO OIL,
STERLING FRICTIONLESS COMPOUND

will cure your troubles.

Canadian Oil Companies Limited,
Toronto, Winnipeg, Montreal, St. John, Halifax, Calgary.

Self-Lubricating

In Cans
6, 12, 25 and 50 lbs.

SAFETY PLASTIC
METALLIC PACKING
LASTS FOR YEARS AND NEVER WEARS THE PISTON ROD

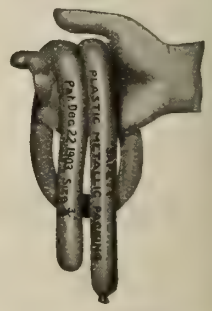
Guaranteed to stand steam temperature up to 550 degrees Fahr.
Guaranteed to stand hydraulic pressure to 5000 pounds per square inch
Packing furnished in bulk and in thin Cotton Tubes, sizes 3-16 to 1½ inch, 36 inches long, or in special lengths to fit your stuffing boxes.
Empty Cotton Tubing in assorted sizes FREE OF CHARGE with orders for the packing in bulk form.
The tubes are easily filled and they save you the expense of carrying a large stock of packings in different sizes.

Send for FREE SAMPLE and particulars

Manufactured only by

STEEL MILL PACKING CO. : WINDSOR, ONT.

Practically Frictionless



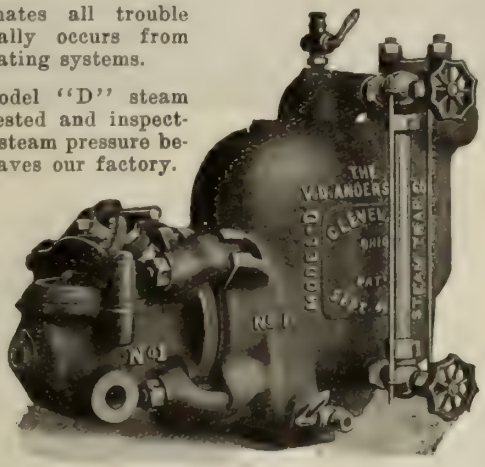
Sold on APPROVAL

The Anderson Model "D" Steam Trap

Drains all Water as Fast as it Accumulates Without Permitting the Escape of Live Steam.

It eliminates all trouble that usually occurs from faulty heating systems.

Every model "D" steam trap is tested and inspected under steam pressure before it leaves our factory.



All parts are interchangeable. The removable perforated strainer, which is part of the equipment, prevents pieces of scale, packing, lead, etc., from entering trap. By our system any **traps can be changed from high to low pressure** or vice versa by simply ordering the necessary valves and seat for pressure desired.

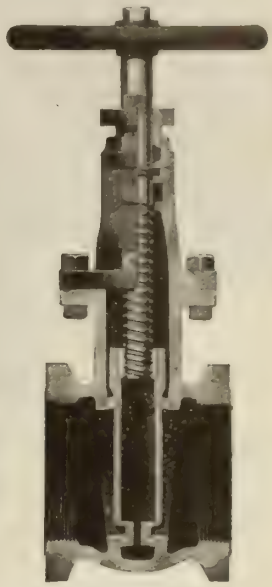
The cut below shows the **complete working mechanism of a Model "D" trap,** consisting of Hanger, Float Lever, Counter Weight and Valve Connection assembled ready to fit into its place on the head. These assembled parts are very accurately built, and fitted up with just the right amount of play to allow for expansion and insure free working.

Write for our descriptive booklet to-day.

THE V. D. ANDERSON CO.
West 96th St., CLEVELAND, OHIO

BRANCH OFFICES: 330 Manhattan Building, Chicago, Ill.; 619 Park Bldg., Pittsburg, Pa.; 3 Arch St., Philadelphia, Pa.; 212 Walnut St., Cincinnati, Ohio; 207 Union Trust Building, Baltimore, Md.; 91 High Street, Boston, Mass.

6 inch Screwed Iron Body Gate Valve



6 inch Interior View of I. B. B. M. Gate Valve

KERR
IRON BODY
GATE VALVES

The above illustrations are of the new **"KEYSTONE"** pattern gate valve which we are now shipping to our customers, and which is being so favorably commented upon by all who have as yet seen them, owing to their modern equipment and strong compact design.

See that

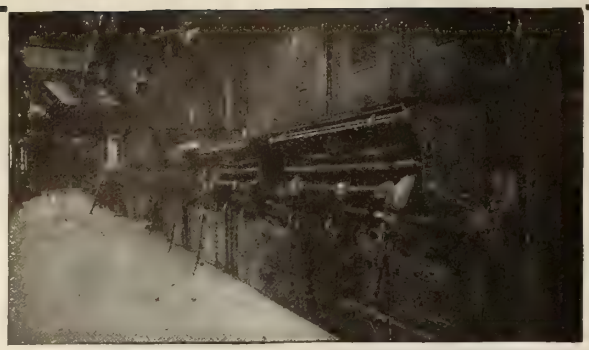
KERR

is on the body of the next valves you buy.

Specify them, and you'll get them.

The Kerr Engine Co.
LIMITED

WALKERVILLE - - ONTARIO



Electrically driven Travelling Hopper, operated from floor; with Chute full width of Stoker.

Jeffrey
Coal and Ashes Handling Systems

work automatically

Constantly as required, saving the time, the expense and delay incident to "Man Handling Methods."

The initial expenditure on a Jeffrey system is not high, while the upkeep costs are on a lower percentage still, that's Jeffrey economy on costs.

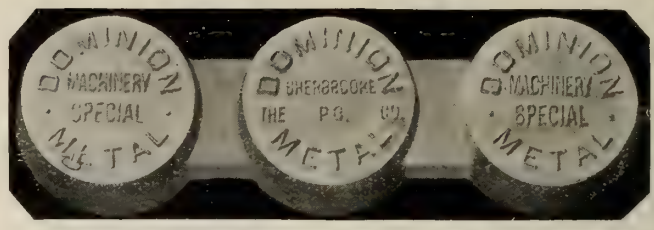
Catalogue 32-A shows how numerous concerns have put their coal and ashes problems up to us, and how we solved them to their satisfaction. It's yours for the asking.

JEFFREY MANUFACTURING CO.

Canadian Works and Main Office, MONTREAL
Winnipeg Representatives N. J. DINNEN & CO.

PRICHARD'S BABBITTS
ARE
SOLD ON MERIT

They are designed to meet modern machinery conditions.



They are all COPPER-TIN-TOUGHENED, are DROSS FREE, and are made from the purest Metals obtainable.
WE want you to know the following of our Brands:

PRICHARD'S EAGLE GENUINE
PRICHARD'S MACHINERY SPECIAL
PRICHARD'S METALLIC PACKING
PRICHARD'S MAPLE LEAF

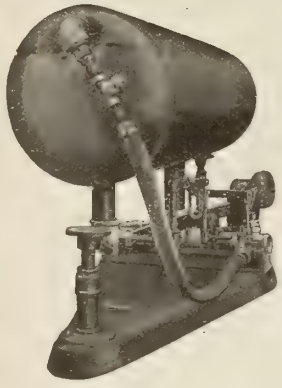
They represent the best that can be made, for **High Speed, Heavy Pressure,** or **General Purpose** use. We make Babbitt Metal ONLY—and we make it specially for any place in which it can properly be used.

Our PRICES ARE ROCK BOTTOM, and are named F.O.B. your nearest RAILWAY STATION. Descriptive Catalogue and Prices on request.

MANUFACTURED BY

The DOMINION METAL COMPANY
N. B. PRICHARD, Prop.
SHERBROOKE, P. Q.

Montreal Selling Agents
Foss & Hill Machinery Co., 344 St. James Street, Montreal



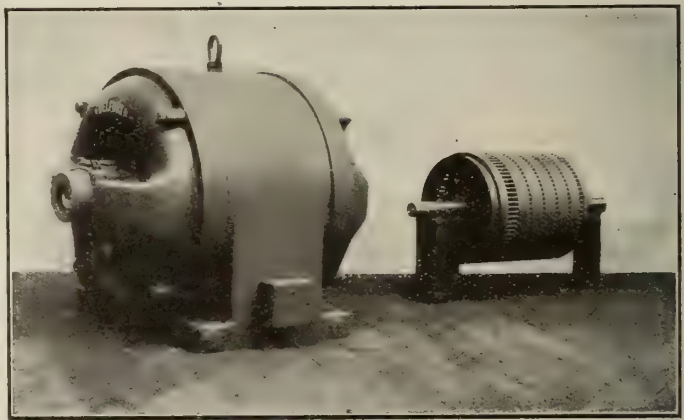
The Morehead Condenser Trap makes its own Vacuum

and PULLS the accumulated water and air out of your steam lines, insuring rapid circulation. Enables you to cut down your boiler pressure on direct heating systems.

Particularly adapted for use in connection with reduced pressure and Exhaust Steam Heating Systems, Dry Kilns, Dryers, Fan Stacks, Etc.

Write for Particulars and a Trial Trap.

Canadian Morehead Mfg. Co.
WOODSTOCK, ONT.



HIGHSPEED INDUCTION MOTOR

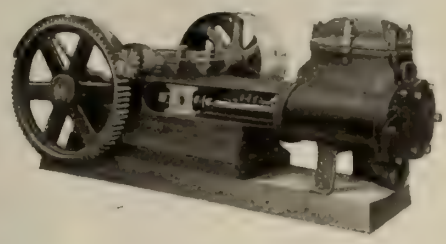
POWER PLANTS, ROLLING MILLS, MINING, HOISTING MACHINERY

ELEVATORS PATENT "STIGLER"

Builders under patents of **"STE. ALSACIENNE"**
Belfort (France) Mulhouse, Grafenstaden (Germany)

Engineering Works of Canada
MONTREAL, Quebec

Steam and Power Pumps, Condensers, Travelling Cranes



THE SMART-TURNER MACHINE CO.
Limited
HAMILTON - CANADA

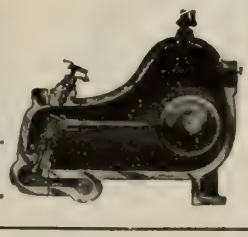
McDANIEL IMPROVED STEAM TRAP

FOR HIGH OR LOW PRESSURE.

Steam can't blow through. They have large discharge valves and cannot be flooded from sudden flushes of water.

MAY WE SEND ONE FOR TRIAL?

Reducing Valves, Pump Governors, Relief Valves, Exhaust Pipe Heads, Ejectors and Steam Separators. SEND FOR CATALOGUE.



THE GARTH COMPANY
26 Craig St. MONTREAL, CAN.
WATSON & McDANIEL CO.,
No. 146 N. 7th St. PHILADELPHIA, Pa.

GRAPHITOL

Pat. and Trade Mark Reg'd.

The graphite cement bearing material.
Another step in the ladder of progress.
A distinct advance over babbitt metals.
The most frictionless material yet produced.
A thorough success.

Write for free illustrated pamphlet describing this material, to

British Pacific Supply Company
F. C. Winkler, Manager,
VICTORIA, B. C.

MAKERS OF GRAPHITOL.

HOMESTEAD
STRAIGHTWAY VALVES

ALWAYS OUTLAST
OTHER VALVES

For Pressure Up to 5000 lbs. per. Sq. In.

The reason is very evident.

Where the common Globe and Gate Valves have their vital parts—the seats—exposed to pressure and constant wear, every minute they are open, the seat of the Homestead Straightway is never exposed.

The plug is balanced and held in place by the pressure when open, and when closed it is locked in the seat by our patent wedging cam, insuring freedom from friction in the seat while the plug is turning and making the Homestead the quickest acting, the simplest, the most easily operated and the most durable valve known.

Let us send full details. Write

Homestead Valve Mfg. Co.
PITTSBURG, PA.

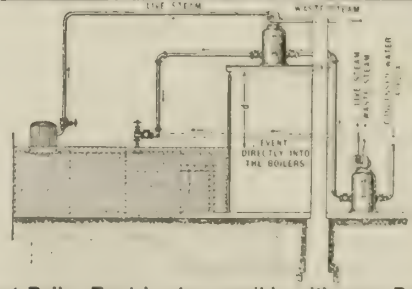
Schneider & Helmecke, Magdeburg Germany

RETURN STEAM TRAP FOR FEEDING BACK HOT

Founded A.D. 1678 — Export

GREAT SAVING IN COALS AND WORKING EXPENSES
INCREASED BOILER EFFICIENCY.
INCREASED LIFE OF BOILER.
MINIMUM OF BOILER INCRUSTATION.

CONDENSED WATER DIRECT TO BOILER, WITHOUT PUMP.



THE MOST RATIONAL — SELF-ACTING BOILER FEED

Direct Boiler Feed is also possible with **one** Return Steam Trap according to the situation.

Dominion Sugar Company, Ltd. We received your favour of the 5th inst. and noted its contents. To our great satisfaction we are able to inform you that your **Return Steam Traps**, are working excellently. We have now installed all **four**, which have worked faultlessly right away from the commencement. — **One** double Return Steam Trap suffices for conveying the condensed water from 6 Sperber drying apparatus directly back to the boilers. — *Since the Return Steam Traps were installed the feed pump for the boilers of the splitting-drying department has not been used.* — **The saving in coals is considerable,** since by aid of the Return Steam Traps we can now easily keep up full steam, **whereas previously we had constantly to force the boilers to the utmost.** After the experience gained with your condensed water Return Steam Traps we must admit, that no plant ought to be without the same. **The feed pump has always been a unisance to us.**
We leave it to your discretion to make whatever use of this you please.
Wallaceburg (Canada), Ont., Novbr. 22 nd, 1909.

The advertiser would like to know where you saw his advertisement—tell him.

The success of all work depends upon the quality of the materials used. Recognizing this engineers and electricians who know the importance of accuracy in equipment buy their supplies from us.

Write for the Engineers' Equipment Catalogue.

THE Northern Electric AND MANUFACTURING CO. LIMITED

Montrea Halifax Toronto Winnipeg Regina Calgary Edmonton Vancouver

VARNISHED CLOTH TAPE — ELECTRICAL ENGINEERS — 12 MIL THICK — BIAS-1" — 2 POUNDS — EQUIPMENT CO.

ADANAC RED CORE RUBBER COVERED WIRES AND CABLES

Are made according to the specifications of the National Board of Fire Underwriters. The conductors are drawn from copper of the highest conductivity and are covered with two thicknesses of thoroughly vulcanized rubber compound of high quality. The wires are braided over insulation and the smooth high finish they receive makes them specially desirable for conduit work.

IMPERIAL WIRE AND CABLE COMPANY

Limited

MONTREAL

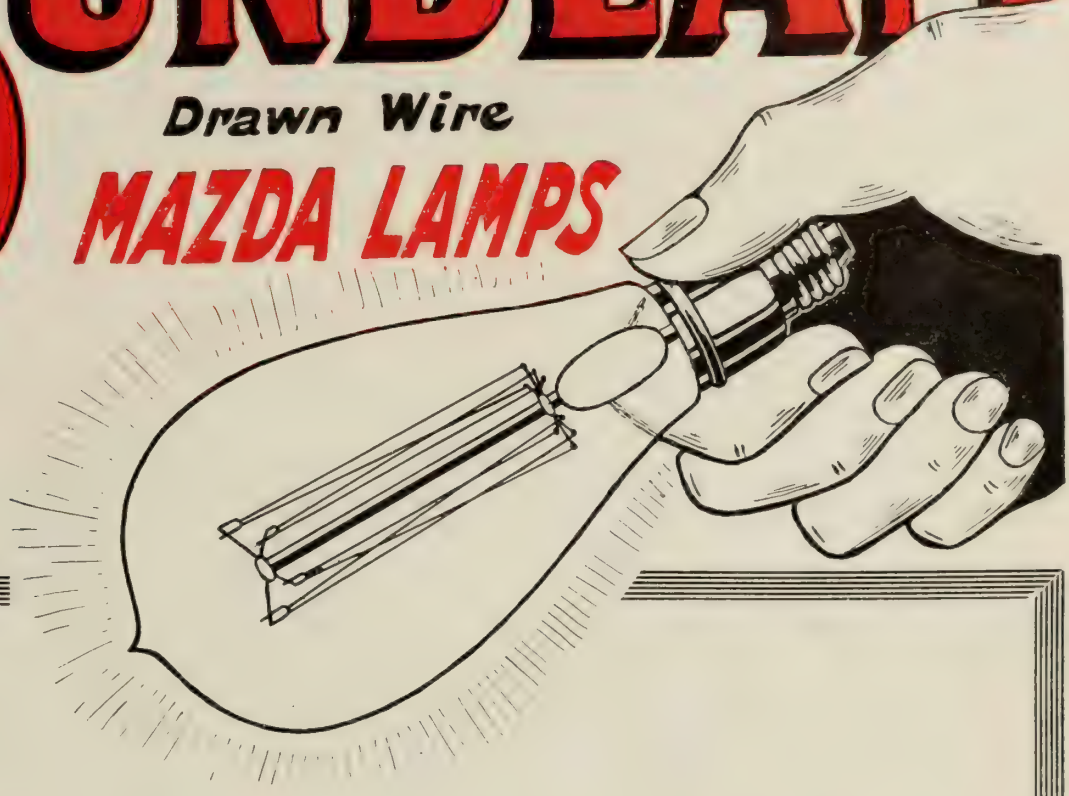
THE Northern Electric AND MANUFACTURING CO. LIMITED
Sales Agents

TORONTO REGINA WINNIPEG
CALGARY EDMONTON VANCOUVER

SUNBEAM

Drawn Wire

MAZDA LAMPS



Give Three Times the Light of Carbon Lamps at the Same Cost

Your lighting problem should be given careful consideration. Your employees cannot turn out high quality work rapidly with a poor light. **"Sunbeam" Mazda Lamps** give a pure white light. They are durable and economical.

All users of carbon lamps should try the "Sunbeam" Mazda at once—the results will be surprising. We deliver promptly.

The Canadian Sunbeam Lamp Co., Ltd.

MAIN OFFICE and FACTORY:
Dufferin and Liberty St., TORONTO

NORTH-WESTERN OFFICE and WAREHOUSE:
173 McDermott Avenue, WINNIPEG

The advertiser would like to know where you saw his advertisement—tell him.

THE

LINDE CANADIAN REFRIGERATION

CO., LIMITED

37 St. Peter St., MONTREAL

REFRIGERATING and ICE-MAKING

MACHINERY

CORK INSULATION

The following are a few of our many Installations :

GORDON, IRONSIDE AND FARES, WINNIPEG (7 Plants.)
C.P.R. HOTEL DEPARTMENT (9 Plants.)
G.T.R. " " (4 Plants.)
SWIFT-CANADIAN CO. (5 Plants.)
P. BURNS & CO. (5 Plants.)
NATIONAL BREWERIES, MONTREAL (4 Plants.)
A. MacDONALD, WINNIPEG (3 Plants.)
MONTREAL GENERAL HOSPITAL.
WINNIPEG GENERAL HOSPITAL.
MANITOBA COLD STORAGE, WINNIPEG (3 Plants.)
NEW BRUNSWICK COLD STORAGE, ST. JOHN (2 Plants.)
NEW WESTMINISTER ARENA, B.C.

ESTABLISHED AND MANUFACTURING IN CANADA FOR 18 YEARS

SEE ALSO PAGE 37

THE LINDE BRITISH REFRIGERATION COMPANY, LIMITED

ESTABLISHED
In Great Britain 27 Years — In Canada 18 Years

has the largest output in the world of refrigerating machinery.

The Windsor Station, Montreal, of the Canadian Pacific Railway, as it is to-day—the largest building of its kind in Canada, and one of the largest in America.

The largest contract for installation of ice-making and refrigeration plant in any hotel or railway station in Canada.

CANADIAN OFFICES: **CORISTINE BUILDING, MONTREAL**

Linde System Can Ice

OVER 8600 INSTALLATIONS SUPPLIED

3239 for Breweries.
1915 for Cold Storage.
1254 for Ice-making.
665 for Ship's Holds and Stores.
205 for Dairies.
253 for Chemical Factories.
34 for Sugar Refining.
68 for Candle and Stearine Mfrs.
63 for Chocolate and Candy Factories.
782 for Various Purposes.

THE LINDE BRITISH REFRIGERATION COMPANY, LIMITED

SOME RECENT ORDERS:

C. P. R. WINDSOR STATION, Montreal, P.Q.
EDMONTON BREWING & MALTING CO., Edmonton, Alta.
CALGARY BREWING & MALTING CO., Calgary, Alta.
BRADING BREWING CO., LTD. Ottawa, Ont.
LADY GREY HOSPITAL, Ottawa, Ont.
BISHOP STREET APARTMENTS, Montreal, P.Q.
HARRIS ABATTOIR CO. Toronto, Ont.
WM. DAVIES CO., LIMITED Fort William, Ont.
WOODLAND DAIRY, LIMITED Edmonton, Alta.

Linde Sytem Plate Ice

Operating in every country in the world, with plants or distributing offices at

Liverpool, Eng.
Birmingham, Eng.
Glasgow, Scot.
Bristol, Eng.
Bombay, Ind.
Calcutta, Ind.
Sydney, N. S. W.
Port Napier, N. Z.
Johannesburg, S.A.

HEAD OFFICE:
LONDON, ENG.

CANADIAN OFFICES:
CORISTINE BLDG., MONTREAL.

REFRIGERATING
AND
ICE-MAKING MACHINERY
FOR
Ice Manufacturers, Packers, Dairies, Breweries
Hotels, etc.

CORK INSULATION of all kinds, furnished or erected complete.

Estimates and fully illustrated Catalogues gladly furnished.
Write us.

THE
LINDE CANADIAN REFRIGERATION CO.
LIMITED

Head Office: 37 St. Peter St., MONTREAL
Branch Offices :
TORONTO : 32 Adelaide Street East.
WINNIPEG : 909½ Main Street.
VANCOUVER : 39 Inns of Court Bldg., Hastings St.

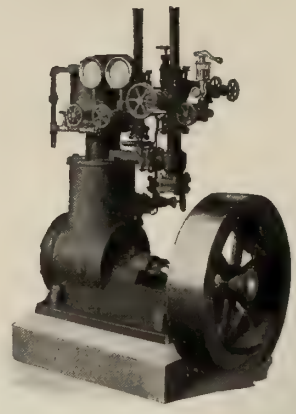
Our Plant covers more than eight acres of ground. Established 1867.

The Vilter Manufacturing Co.

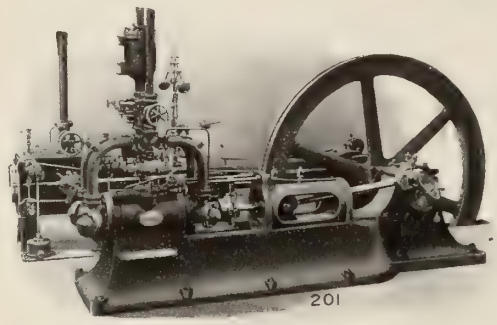
242 Becher Street MILWAUKEE, WIS., U.S.A.

BUILDERS OF HIGH-GRADE CORLISS ENGINES

for Belted or Direct Connected Service, Medium or High Speed (Girder or Heavy Duty Type Bed.) Perfect Regulation, Highest Efficiency. ICE and REFRIGERATING MACHINERY, Small Single-Acting Vertical and Small and Large Double-Acting Horizontal, any capacity. AMMONIA FITTINGS, AMMONIA PIPING, AMMONIA CONDENSERS, DOUBLE-PIPE BRINE COOLERS AND EQUIPMENTS FOR ICE PLANTS.



Vertical Single-Acting Ammonia Compressor, Enclosed Type for Belt-drive.



Horizontal Double-Acting Refrigerating Machine driven by Corliss Engine.

Some of Our Canadian Customers :

Windsor, Ont.—British American Brewing Co.

Ingersoll, Ont.—Ingersoll Packing Co.

Hamilton, Ont.—F. W. Fearman Co., Ltd.

London, Ont. — Canadian Packing Co.; London Machine Tool Co.

Rat Portage, Ont.—Rat Portage Lumber Co.

Winnipeg, Man.—Edelweiss Brewery; Winnipeg Fish Co.

Saskatoon, Sask.—Hoeschen-Wentzler Brg. Co.

Strathcona, Alta.—The Strathcona Brewing & Malting Co.

Calgary, Alta.—Mountain Spring Brewing Co.

Rossland, B.C.—Lion Brewing Co.

Victoria, B.C. — Victoria Phoenix Brg. Co.; Victoria Arena Co., Ltd.

Vancouver, B.C.—Vancouver Arena Co., Ltd.; British Columbia Breweries, Ltd.; Vancouver Breweries, Ltd.

Montreal, Can.—Frontenac Breweries, Ltd.; N. K. Fairbank Co.

Pure, Sparking

ICE from RAW WATER

is being manufactured at reduced cost per ton on our system. Use any cheap motive power, no distilling apparatus required. Ice is made in standard size cans, every block uniform, with the

Arctic-Pownall Raw Water System

You will make ice with a lower labor and fuel cost than you ever thought possible.

You'll enjoy **Arctic Printed Facts.**

The ARCTIC Ice Machine Company

CANTON, OHIO, U.S.A.

R. CAMPBELL

COLD STORAGE BUILDER

I have made a special study of the Design, Construction and Insulation of Cold Storage Buildings and Refrigerated space for all purposes, and prospective Builders and Owners of such would find it to their advantage to get in touch with me before building or extending their plants.

I can build to suit the amount of money at your disposal and with the materials best suited to the many conditions which exist even in one plant.

Specifications and Estimates cheerfully submitted without obligation, for work in any part of Canada. If the job is comparatively small and distant I can furnish complete drawings, specifications and directions, so that the work can be done by local mechanics, or I can send one man to superintend the work.

I have contracts just completed or under way for the following:—Matthews-Laing, Limited, Toronto; Gunns, Limited, Toronto; Maciver Bros. Company, Toronto; Alerts Limited, Hamilton; Burke Bros., Hamilton, etc.

67 Victoria Street, TORONTO

Phone—Adelaide 3937

The advertiser would like to know where you saw his advertisement—tell him.

HOCKEY

Indoor Ice Skating and Hockey are made possible by Mechanical Refrigeration

The Ice Skating Rink affords the pleasure of this sport without regard to outside weather conditions.

We are the pioneers in this field of Refrigeration. We have just completed two large rinks in the Dominion, one for the Arena Gardens in Toronto, and one for Alert, Ltd., in Hamilton.

Our machines are the standard in their class. Their lasting qualities are attested by the fact that **many machines installed twenty years ago are to-day maintaining their high initial performance.**

Over thirty years of experience in the field of Mechanical Refrigeration cannot fail to show beneficial results in our products.

We are prepared to meet any condition of operation or output from our standard line (**each machine, of which is backed by our guarantee**) and brings the greatest possible security to the user.

Let us know your requirements.

OIL ENGINES **ICE MACHINES** **REFRIGERATING MACHINES**

DE LA VERGNE MACHINE COMPANY

FOOT OF E. 138th STREET **NEW YORK**

The advertiser would like to know where you saw his advertisement—tell him.

J. V. Jamison, President. T. B. South, Vice-President. J. V. Jamison, Jr., Treasurer.

This "Ad" is addressed to users of

Refrigerator Doors, Windows and Ice Chutes

in Canada

for Cold Storage, Meat, Fish, Dairy, Poultry, Fruit and Vegetable products.

We guarantee our Doors not to sag or stick in the frames.

Our Hardware weighs 60 lbs. to set.

We manufacture or sell nothing else.

Our entire time and forces are directed to this line.

We supply

Linde British Refrigeration Co.
Linde Canadian Refrigeration Co. of Canada.
Armour & Co., Chicago, Ill., U.S.
Swift & Co., Chicago, Ill., U.S.

with all they use. Our latest orders are to Swift & Co., for Toronto, Can., 30 Doors; Canadian Fish and Cold Storage Co., Prince Rupert, B.C., 110 Doors.

Send for Catalogue

Jones Cold Store Door Co.

HAGERSTOWN, MARYLAND, U.S.A.

Canadian Association

OF

Stationary Engineers

To all whom it may concern:

All those operating steam or electrical plants know that to advance in their special profession something new must be added constantly to keep up with the rapid developments in all the branches of the engineering profession. To you I offer the undisputed facilities and benefits to be derived by being a member of the C.A.S.E. This year has seen greater developments in our executive, owing to the aforesaid profession advancing so rapidly.

It is the wish of the present membership that all operating engineers should become members, so that we may hold our profession in the front ranks of scientific industry.

You will readily see the great advantages that would accrue from such a source.

If not a member
Why not a member?

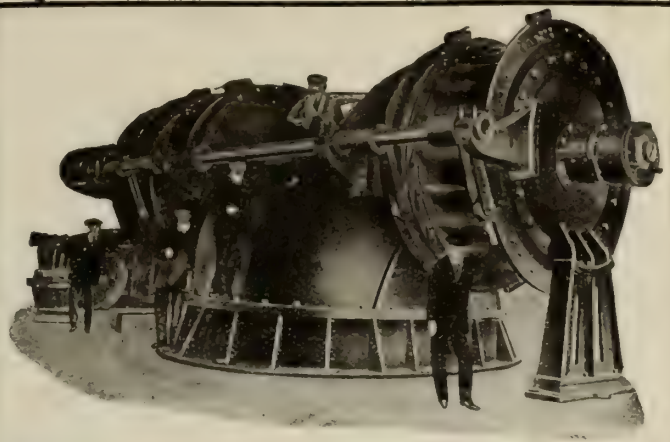
Act at once and write for further information concerning membership to

A. KASTELLA,
Executive Secretary,
Stratford, Ont.

WATER TURBINES
AND
GOVERNORS

All Sizes

Maximum Efficiency



All Heads

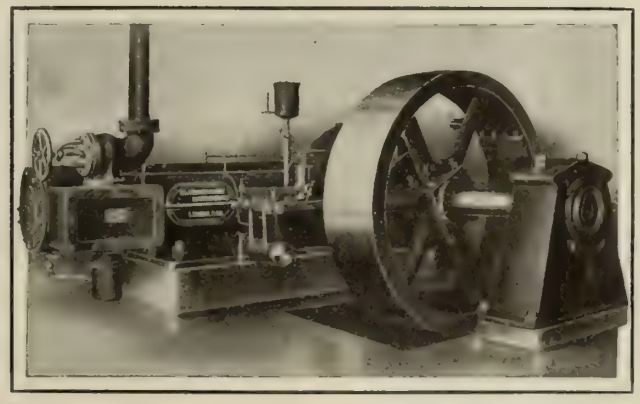
Ideal Control

ASK FOR PARTICULARS FROM

THE CANADIAN BOVING CO., LTD.

164 BAY STREET, TORONTO.

Branch Office for British Columbia, 427 Seymour St., Vancouver



Side Crank Leonard Automatic Engines

Particularly adapted for Direct Dynamo Connection and Electric Light Service. Made in Simple and Compound Units up to 500 Horse Power. For High Economy and Close Regulation this engine is unexcelled.

We also make High and Slow Speed Corliss Engines for Heavy Duty Service. Our "Tangye" Engine is very well and favorably known throughout Canada for Sawmill Work.

MADE BY

E. LEONARD & SONS, LONDON, ONTARIO

MANUFACTURERS OF

High and Slow Speed Engines of all kinds, Boilers, Heaters, Pumps, etc., etc., and complete Steam Plants.

WAREHOUSES AND AGENCIES AT

MONTREAL, ST. JOHN, N. B., CALGARY, WINNIPEG, VANCOUVER

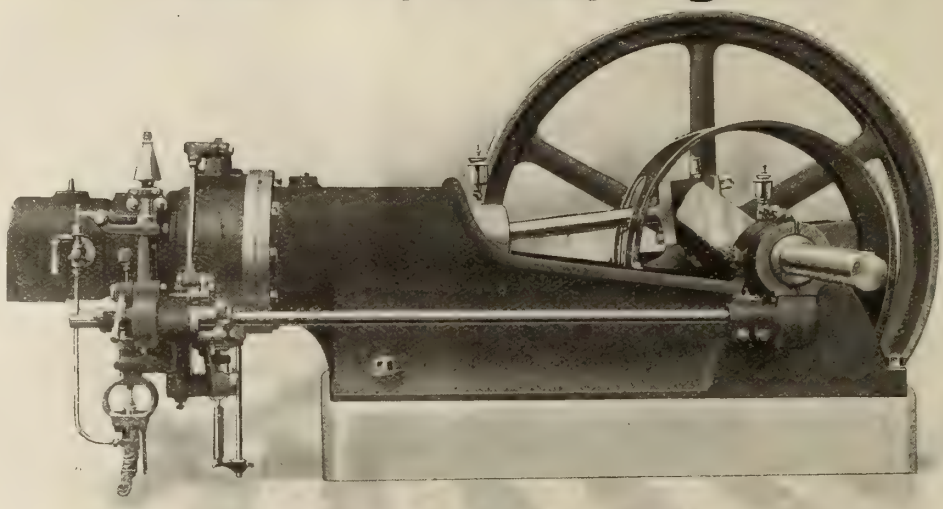
The advertiser would like to know where you saw his advertisement—tell him.

ESTABLISHED 1870.

JOHN ROBSON, (Shipley), Ltd.

SHIPLEY, Yorks, England.

Sole Makers of the "Robson" Oil Engine for working on Crude and Petroleum Oils.

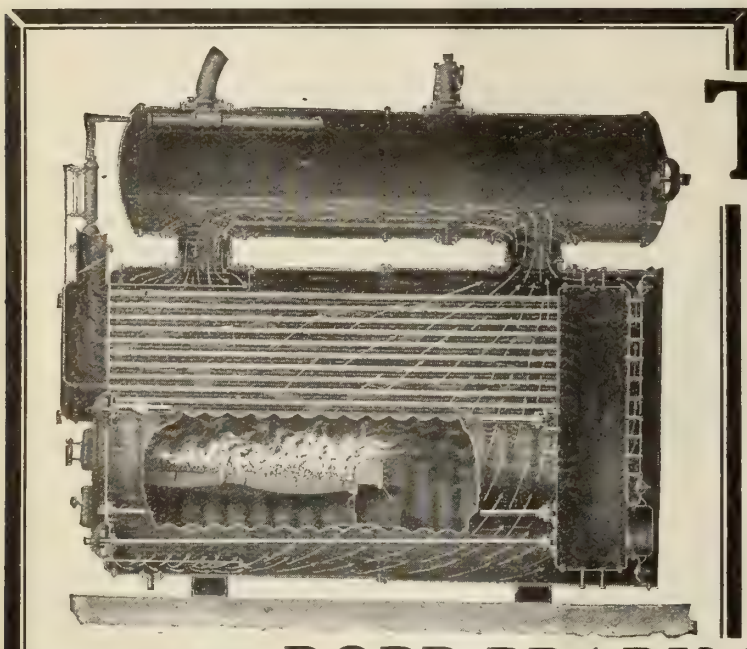


Sole Makers of the "Robson" Engine for working on Towns and Suction Gas.

"Photograph of Oil Engines, (new design) 3½ to 20 B. H. P."

Suction Gas Producer Plants for working on Anthracite Coal, Coke or Charcoal.

AGENTS WANTED. **WRITE FOR CATALOGUE.**



TESTED

Four thermometers were placed in oil wells to show rise in temperature as the boiler was fired up. When the upper thermometers indicated boiling point, the lower thermometers rose rapidly. At 100 pounds pressure all four gave the same reading. No dead water beneath the furnaces.

A modification of the standard marine boiler, adapted to plants ashore. The chief new feature is rapid circulation. It does away with the flat top combustion chamber. Its staying is simple.

ROBB-BRADY SCOTCH BOILER

International Engineering Works, Limited

Manufacturers of Robb Engines, Boilers, Etc.

Ask for Bulletin No. 3

WORKS: Amherst, N.S. / South Framingham, Mass.

Manufacturers of Return Tubular Boilers, Water-tube Boilers, Vertical Boilers, Engines, Macdonald Shaking Grates, Etc.

DISTRICT OFFICES:

Transportation Building, Montreal,	R. W. Robb	Mgr.
Traders Bank Building, Toronto, -	Wm. McKay	"
Union Bank Building, Winnipeg -	W. F. Porter	"
Grain Exchange Building, Calgary,	J. F. Porter	"

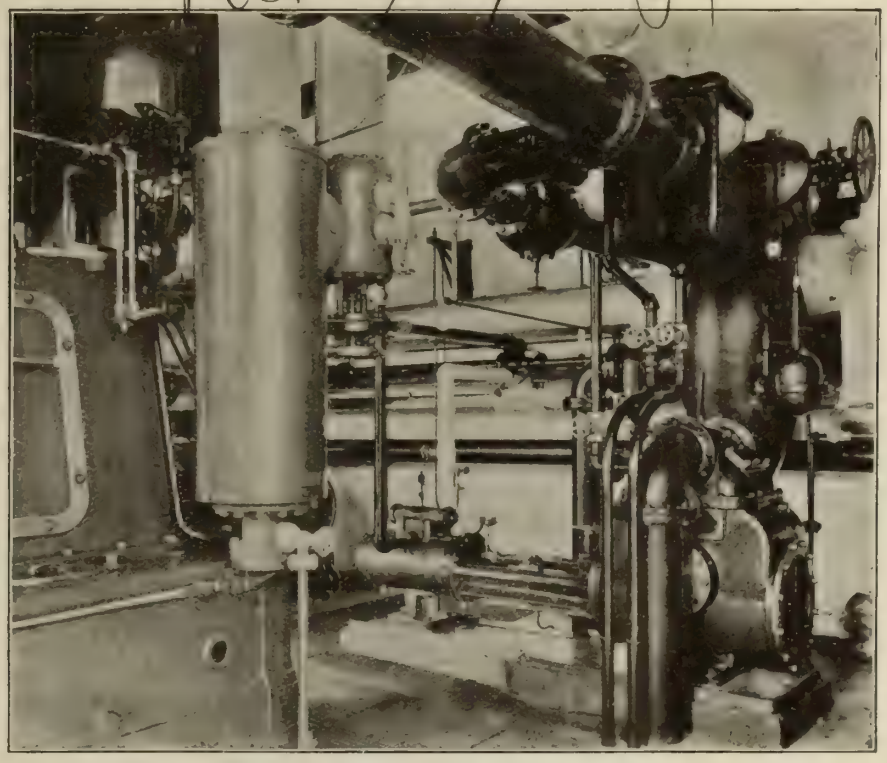
Sole Canadian Agents for C. A. PARSONS & CO., Newcastle-on-Tyne TURBINES, TURBO-ELECTRIC GENERATORS, TURBO-PUMPS, and COMPRESSORS. 39-39

The advertiser would like to know where you saw his advertisement—tell him.

STEAM CONDENSERS

Designed to Meet the Demand for Higher Economy of Steam.

Ref 5/21/15 JH



Condensing Equipment of a High Speed Engine driving Electric Generator.

An independent air pump and cone jet condenser will save from 20 to 30 per cent. in steam when applied to non-condensing steam engines, or will give a corresponding increase of power.

But many condenser installations are not satisfactory and some are absolute failures, because local conditions were not properly considered before the type and make of apparatus were determined.

We have had long experience in designing and building condensing apparatus under widely varying conditions. Our installations have been uniformly successful.

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., Limited

Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

Works: Seigneurs & Williams Streets, MONTREAL. **Sales Offices: Montreal, Toronto, Cobalt, Winnipeg, Calgary, Vancouver**

The advertiser would like to know where you saw his advertisement—tell him.

At This Ice Plant

1 TERRY TURBINE DRIVEN PUMP

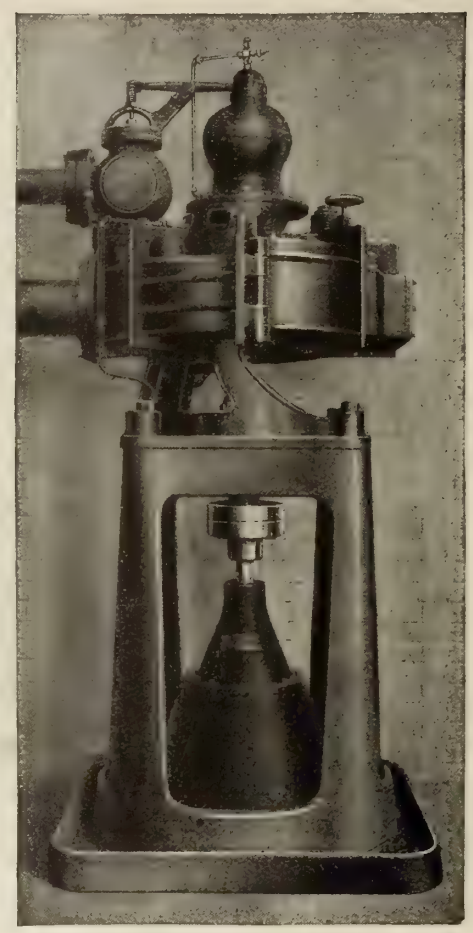
SHUT DOWN

7 RECIPROCATING PUMP SETS

In March, 1912, a prominent Ice Company in the U.S. installed a Vertical Terry Turbine Driven Centrifugal Deep Well Pump, and now writes as follows:

"We connected a Terry Steam Turbine to this outfit and after starting same up we shut down seven deep well pumps of the ———— make. We have been running the above outfit from that time and are running same at the present time without one cent for repairs. This outfit not only cut repair account for pumping water, but shows a big saving in our consumption of cylinder oil, as we use 3½ gallons of oil every 24 hours on our 7 deep well pumps. We used to take out the rods and put in new leathers for the deep well pumps every three weeks, but since starting the Terry outfit this labor and expense have been entirely done away with."

This firm also state that they condense the exhaust steam to make ice, and as the Terry's exhaust is free from oil they "are now making **clear ice,** it being free from oil and much **better ice** than we have ever made during the last six years."



Terry Turbine Driven Vertical Pump Set at Large Ice Plant.

The above is a typical letter we receive from users of Terry Turbine Driven Pumps, Generators and Blowers. It is the kind of a letter you would expect us to receive when you are aware of the fact that of the 1250 Terry Turbines now in use, more than 850 have been sold on repeat order.

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Terry Turbine Driven Pumps are also used by coal storage companies, ice companies and breweries for pumping brine, for which service they are ideal. ¶ As the exhaust steam is absolutely free from oil and as the Terry Turbine may be operated without leakage against back pressures up to 30 pounds, the exhaust steam may be used for heating and manufacturing purposes. Terry Turbines have many advantages over reciprocating engines. They retain their initial high economy after years of service; they occupy one-third to one-quarter the space; and the cost of installation is much less than for reciprocating engines. In the Terry Turbine there is only one revolving element, and two bearings, making the wear much less than with an engine set, meaning negligible repair bills and a minimum of attendance. Terry Turbine Driven Pumps are now used in scores of industries for driving boiler feed, condenser circulating, fire and other pumps. Terry Turbing Driven Electric Lighting Generators and Exciters, Forced Draft Fans, etc., have been widely adopted. This turbine represents the best in small turbine construction.

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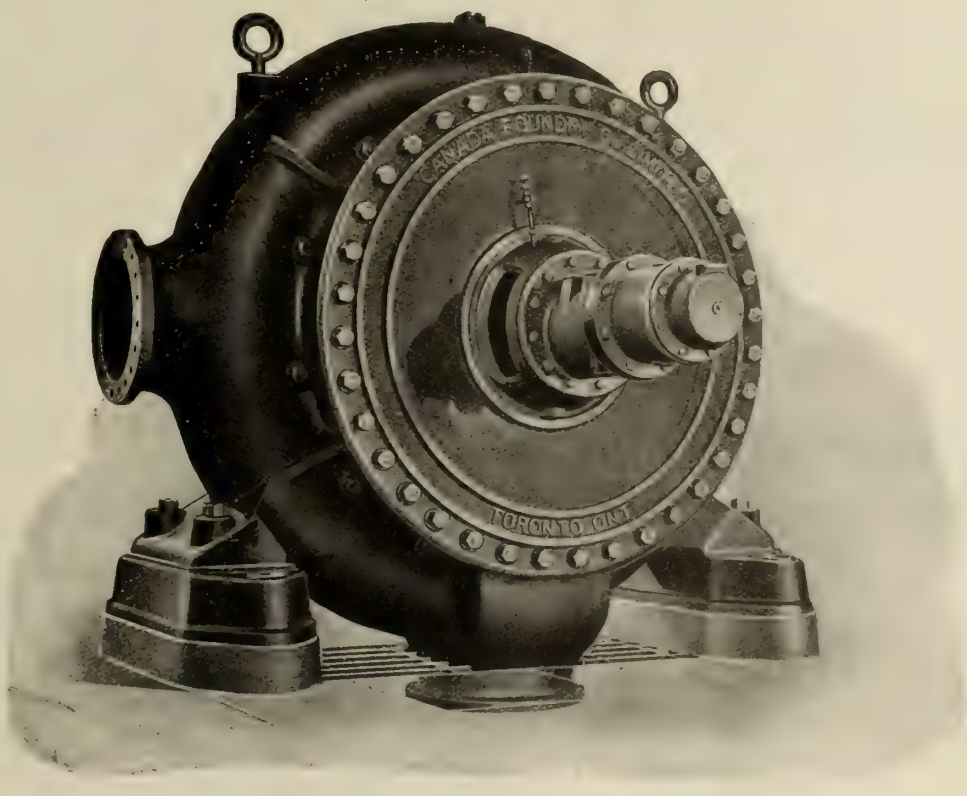

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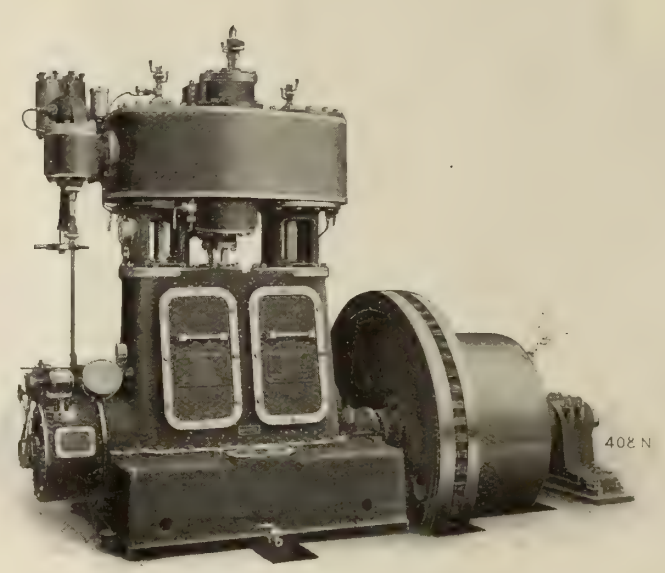

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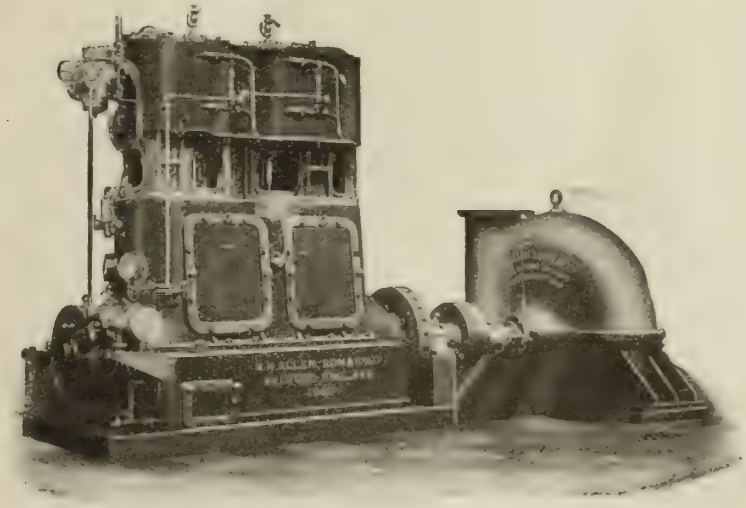

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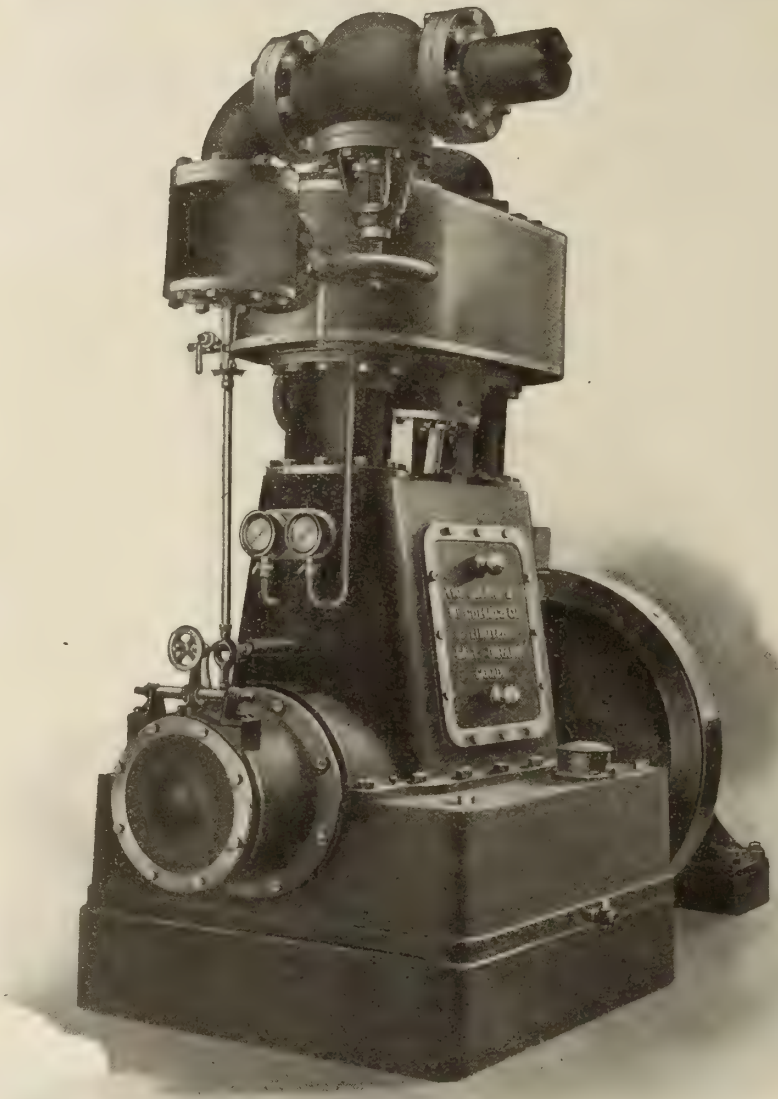

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Insulation in Refrigerating Plant and Power House

By R. Campbell

The subject of thermal insulation is one of the most important to be considered in connection with the efficient operation of a cold storage plant, and is of hardly less importance in a steam plant. This article is by a refrigeration expert and will prove of interest to all cold storage men. It will be followed in a future issue by a paper on the insulation of boilers and steam pipes.

THE subject of insulation is one which has had liberal treatment at the hands of technical writers. The articles, however, which have appeared on this topic have been treated from the standpoint of the manufacturer of some insulating material either in a manner too technical for the average engineer or owner, or they were written a few years ago and are therefore now obsolete.

Cold storage construction and insulation have been completely revolutionized during the past decade. The old air space construction is gone for good and also the method of using a packing material between wood construction. This was absolutely necessary for several reasons, chief among them being the fire risks attached to air space construction, the rapidity with which it deteriorates, the increased space occupied, and the ever increasing cost of lumber.

Economy of Good Insulation.

Pipe insulation seldom receives the amount of attention which it deserves. It is generally overlooked until the plant is ready for operation, the result being that it is hastily collected, and applied; and the appropriation for the equipment of the plant being in all probability exhausted, the cheapest material obtainable is often used.

It is now generally recognized that a good pipe covering, properly applied, will return its entire cost within one year from its application. A cheap and less efficient insulation will no doubt also return the outlay on it in a similar period, but at the end of this time it will probably be found that the good insulation is preventing double the amount of loss as the inferior one, and this from year to year during all the succeeding years of operation. The result is that each year the owner who has installed the inferior insulation has a positive loss amounting to at least half the initial cost of the good insulation. This illustrates the folly of endeavoring to save money by using cheap insulation. Is it a wonder then that owners and their engineers are now making provision in their initial estimates of capital expenditure for efficient insulation ,and are seeking for reliable data on this subject.

It is the purpose of this paper to discuss the materials and methods of insulation in a manner which should prove of interest and instruction to those who are seeking impartial information on the subject. The matter will be treated under four heads, not only to make reference easier but because under each head ,although the governing principle is the same, the materials used and methods of erection are altogether different. The divisions of the subject are as follows:—

1. Cold storage rooms.
2. Piping and tanks containing low temperatures.
3. Steam piping, boilers and heated surfaces generally.
4. Outside piping, underground and overhead.

Cold Storage Rooms.

The insulation of the cold storage building is probably the most expensive part of the plant, not alone in its initial cost but also, providing the work is not properly done in the power expended in making up for the loss incurred by poor insulation. It is therefore the part of wisdom for those who are building to make themselves familiar with the materials and methods of erection which have been proved satisfactory.

Corkboard or sheet cork is now almost exclusively used for cold storage insulation. It is made from the waste material produced in the manufacture of cork articles and also from the lower

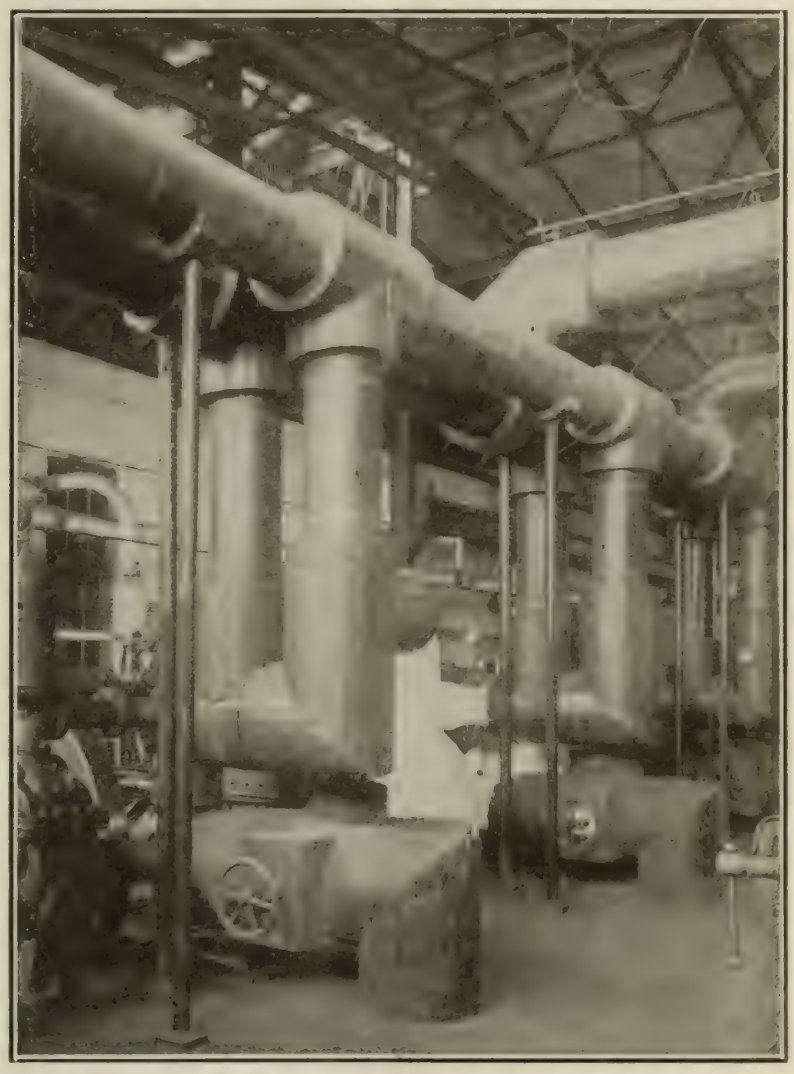


FIG. 1. CORK COVERING ON FLANGED BRINE PIPING AT STEEL CO. OF CANADA REFRIGERATING PLANT, HAMILTON, ONT. THE 8 IN. X 12 IN. SUCTION HEADERS ARE UNDER THE FLOOR.

grades of the cork-bark. This is crushed into granulated form, compressed in molds, baked and trimmed to the desired size.

About three years ago the patents on the process of manufacturing sheet cork expired, with the result that several companies are now manufacturing a good article and the price has come down to a point which makes it one of the few materials worth considering for cold storage work. It has proved its efficiency beyond question and it is now very widely used.

The owner should see that he gets material made from pure, sound stock, compressed and baked to the proper degree, and that it is erected under the supervision of some one who has had plenty of experience at this class of work. The vital parts of the work will be all hidden on completion, hence the necessity for conscientious and experienced workmanship all the way through. Corkboard is not proof against moisture penetrating into the spaces between the particles, it is therefore necessary to have an impervious surface on both sides of the insulation and especially on the outside, because insulating materials depend for their value on the minute air spaces which they contain. When the temperature of these is reduced the air pressure is also reduced, causing a partial vacuum into which the surrounding warm air endeavors to flow. Warm air generally carries moisture which would thus be deposited in the insulation, providing it can penetrate the surface, thereby decreasing its value and in time making it worthless. For this reason an impervious surface is required and this is the secret of efficient insulation for low temperatures.

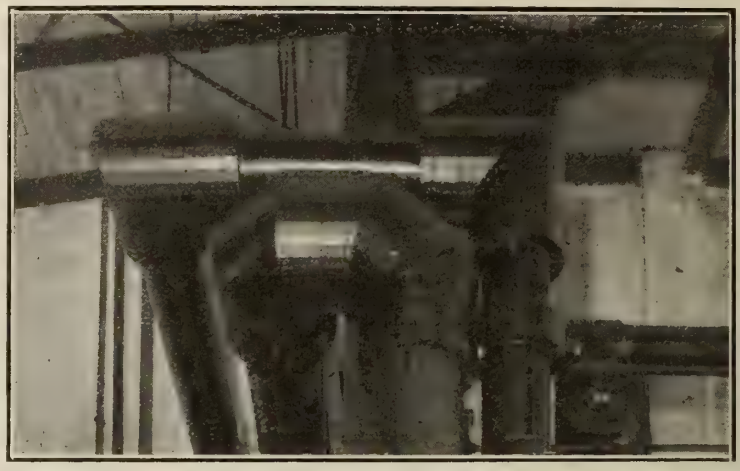


FIG. 3. A DIFFICULT PIECE OF PIPE COVERING. CORK COVERING ON 8 IN. X 12 IN. FLANGED BRINE PIPING.

FIG. 2. VIEW SHOWING TWO VERTICAL BRINE COOLERS (SHELL TYPE), INSULATED WITH CORK LAGGING. TOP AND BOTTOM BOXED IN AND FILLED WITH GRANULATED CORK, ALSO SHOWING 8 IN. X 12 IN. BRINE RISERS.

This surface can be obtained in different ways ,but preferably by a Portland cement plaster finish applied directly to the cork, which should be scored to receive the plaster, or by a coating of good bitumen. This is the chief point to be noted in the erection, whether it is on the walls, floors or ceilings. The methods of fastening will depend altogether on the conditions to be met, and each job must be considered by itself to give the best results.

Insulation Should be Embraced in Original Design.

In new buildings the insulation is generally left out of consideration until the framework of the building is completed. This is a great mistake. The insulation should be worked in with the general design and in some cases put in position with the framework of the building. A great saving can often be effected in this manner. The proper laying out of the room is another item on which economical results depend. Low temperature rooms in basements should be avoided on account of the danger of freezing the earth under the foundations. If moisture is present there is a possibility of heaving the building. This has frequently occurred with disastrous results.

The minimum thicknesses of sheet cork for the different temperatures to be carried are as follows:—

10 to 5 deg. F.	6	inches
5 to 15 deg. F.	5	"
15 to 30 deg. F.	4	"
30 to 45 deg. F.	3	"
45 to 60 deg. F.	2	"

Of course this will be governed to a great extent by local conditions, the construction and arrangement of the building, etc.

Sheet cork made by mixing granulated cork with some form of asphalt binders should not be used for cold storage work. Its cheaper price does not offset its lower efficiency as compared with pure sheet cork. Manufac-

turers make this grade to use up the trimmings of the pure sheets. The only place where it should be considered is on the floor of a comparatively high temperature room, where there is an excessive amount of water present.

Brine Ammonia Piping, Etc.

Brine circulating pipes and gas lines in connection with refrigerating plants, when these are outside of the space which they are to cool. Brine coolers, brine storage tanks, and ice-making tanks, require to be insulated in order to maintain the low temperature within and also to prevent the "dripping" which occurs when the circulation ceases. This class of covering is the most difficult which confronts the engineer. The materials and methods employed are entirely different from those used on steam work. In the latter it is the material that counts; the manner of application in ordinary cases is not important except where a neat finish is required.

With brine work the position is reversed. The best materials obtainable are of little value unless carefully applied, and it is imperative that the finished surface be quite impervious to air and moisture in order to prevent the inrush of warm air into the insulation, as explained under the paragraph above on cold storage rooms.

It is also important that sufficient space be provided around the piping to be covered. At least three inches should be allowed, and where flanges are used this same distance should be provided outside the flange. Where two brine pipes run alongside they should be at least 8 inches apart. Few erectors give sufficient attention to this point. It should be remembered that the covering cannot be applied satisfactorily when the plant is in operation.

Hair Felt Covering.

The suitable insulating materials available are few. Theoretically hair felt is the most efficient insulation in a commercial form, and good work has been done with it. Some of the largest users still specify it and will no doubt continue to do so until there is some competition in the manufacture of a more suitable covering.

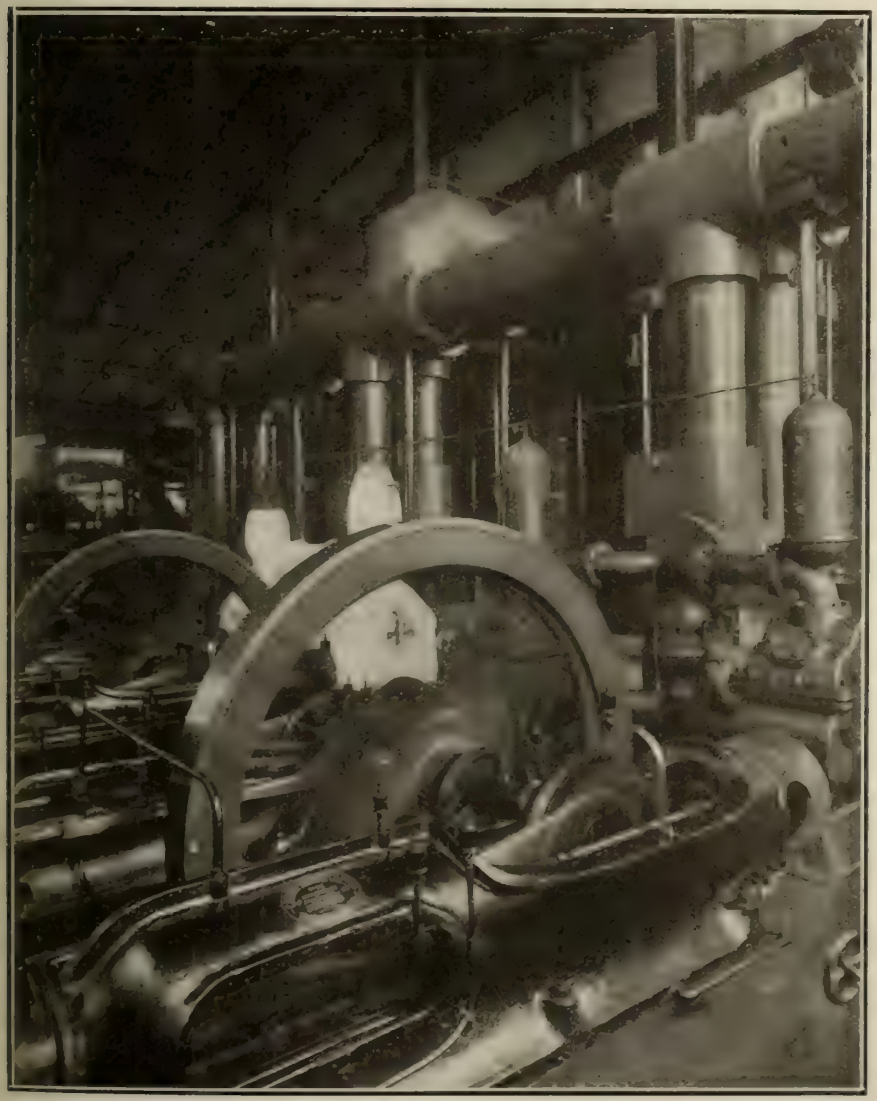


FIG. 4. VIEW IN ENGINE ROOM OF STEEL CO. OF CANADA REFRIGERATING PLANT, HAMILTON, ONT., SHOWING BRINE PUMPS AND THE PIPING INSULATED WITH CORK.

For covering pipes two layers of one-inch air felt are required for temperatures down to 15 deg. F. and below this three layers should be applied. Each layer must be tightly wrapped on the pipe with strong twine, bound spirally one half inch apart. Between each layer of felt two layers of tarred roofing felt should be applied, with joints broken and cemented between the layers with pitch or asphalt. The outside finish should consist of a wrapping of factory cotton bound on spirally and thoroughly coated with asphalt, then a layer of heavy building paper and finally a canvas jacket of 7 oz. duck sewn on. This may be painted with oils to any color desired. The heavy paper makes a uniform surface and prevents the asphalt showing through and disfiguring the jacket.

The fittings are done in the same manner, but not until the straight runs are finished. The covering on the straight runs should stop three inches away from each fitting and hanger and the ends should be sealed up tight with cotton and asphalt before the fittings are commenced. By attending carefully to this latter point the piping may be taken apart if necessary without destroying the covering on the straight runs of pipe.

Cork Covering.

Sectional cork covering as manufactured by the Armstrong Cork Company at Camden, N.J., is an efficient covering, but must be carefully applied so that all joints are perfectly tight. This is best accomplished by applying a liberal quantity of the cement provided and wiring on tightly so that the cement will ooze out of the joint for its entire length, giving particular attention to the end joints. It will sometimes be necessary to periodically paint the wires to prevent rusting. Where skilled help is not available and in difficult positions this covering should be used. It should be approximately three inches thick for ordinary cold storage work and thicker where conditions are severe, as over boilers and passing through warm rooms. Hangers should be made to go round outside the covering and on the larger sizes a protection of sheet iron should be provided on the under side.

The accompanying illustrations show examples of cork covering on large brine piping. The covering on piping over 8 inches in diameter and also on the larger fittings required to be built up to lagging, as will be seen in illustrations.

Cold Water Pipe Coverings.

For ordinary cold water lines the conditions are similar to the brine, but not

nearly so severe. Any good pipe covering firm can supply a sectional covering for cold water lines. The material of which it is made should be impervious to moisture. Asbestos coverings are not satisfactory for this purpose.

Brine Coolers.

Brine coolers of the shell type are difficult to insulate properly. The body of the cooler should have cork laggings held in place by metal bands. The ends should be encased in a tight wood box composed of two layers of matchings with waterproof paper between and filled in with granulated cork. The ends should be made so as to be easily removable for repairs or inspection.

Brine Tanks.

Sheet cork embedded in asphalt and coated with the same material should be laid under the area of the tank. The thickness should be as specified under cold rooms. After the tank is put in position 2 in. by 10 in. scantlings should be erected around the sides, sheeted with two layers of ⅞-inch matchings on outside, with waterproof paper between and the space between the studdings filled with fine granulated cork. If the top has to be insulated the cover should be made in sections of convenient size built up of wood, matched top and bottom, with sheet cork between and having a layer of waterproof paper on both sides of the cork.

The packing around the sides of the tank is an exception to the rule laid down in the article on cold rooms. Sheet cork could be used on the sides, but on account of the difficulty of applying it so as to withstand the expansion and contraction it is only used occasionally in this position.

The continuation of this paper, taking up the steam end, will appear in a future issue.

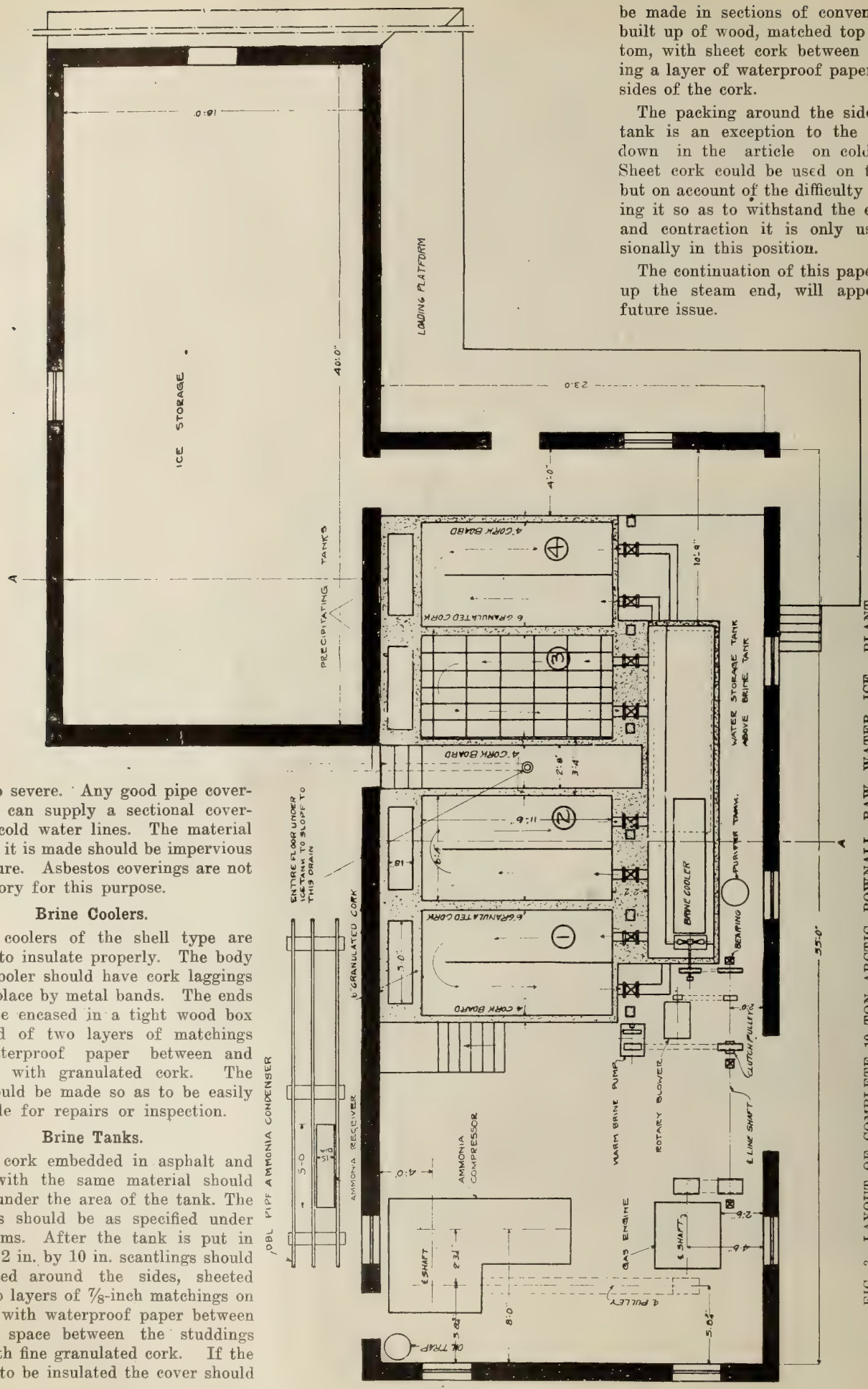


FIG. 3.—LAYOUT OF COMPLETE 10 TON ARCTIC POWNALL RAW WATER ICE PLANT.

Description of a Raw Water Ice Plant Installation

By C. T. R.

Economy of space and power appear to be prominent advantages of this particular raw water ice plant; the fact that natural gas was available, being, of course, a not inconsiderable contributory to the highly favorable results obtained.

OWING to the continually increased demand upon their ice-making capacity, the owners of the City Ice Delivery Company, Mt. Vernon, Ohio, decided to increase their output by the addition of a 10-ton ice-making installation. The task of selecting this equipment was undertaken in a particularly thorough manner. Mr. Mild, the president, had formerly been engaged in the ice machine industry, and hence was unusually critical in buying for his own needs. After carefully canvassing the question and visiting a number of plants through the State, the order was placed with the Arctic Ice Machine Company, of Canton, Ohio, for a 10-ton plant, making ice on the Arctic-Pownall Raw Water system. The ice machine experience of the purchaser caused him to quickly perceive the advantages of this type of installation, which is fully described in the following:—

Fig. 1 shows the exterior of the building, which is located on the B. & O. Ry. tracks convenient for shipping ice to the surrounding territory. The compactness of this entire 10-ton installation may be understood from the fact that the building here shown, which houses the entire ice-making equipment is only 55 feet long by 23 feet wide, and but one storey in height. The building is a brick structure on concrete foundations, with cement floors. The roofing is of mill construction and covered with heavy galvanized iron.

Adjoining the tank room is an ice storage house, 40 feet long by 18 feet wide and 8 feet high. This storage house is also of brick on concrete foundations with galvanized iron roof, the storage being efficiently insulated with four inches of compressed cork and finished with a half-inch coat of plaster cement. Stevenson doors are provided to handle the shipping trade, and a special side track was laid leading directly to the storage room. A temperature of about 26 deg. Fahr. is maintained in this apartment, by means of 2-inch direct expansion coils.

The Mechanical Equipment.

As one enters the main building, to the left is the gas engine which operates the Arctic horizontal, double-single acting ammonia compressor, as shown in Fig. 2. This compressor is 9 inches bore by 13½ inches stroke, and is of the now well-known Arctic construction, wherein the gas enters the compressor through grated ports in the centre of the cylinder between two piston heads, in which are located the suction valves. The type of suction valve used contains fewer parts than are found in any other construction, the valve being springless and inertia operated; and due to the absence of springs and the extremely large diameter of the valve, the gas fills

FIG. 1.—10 TON ICE PLANT OF THE CITY ICE DELIVERY CO., MT. VERNON, OHIO.

the cylinder at practically the same pressure as exists in the suction pipe, a condition which cannot exist in compressors fitted with poppet, spring-loaded suction valves.

The water jacketing of this compressor is of unusual construction, both the cylinder heads and a portion of the stuffing box, also that portion of the cylinder representing the last 50 per cent. of the stroke being effectually water jacketed. The centre portion of the cylinder is cork insulated. This construction allows the gas to enter the cylinder without any chance of absorbing heat, and at the same time, insures the constant removal of heat through the cylinder walls and heads. Low temperature of the cylinder walls is another advantage resulting from this type of construction .

The discharge valves are located directly on the under side of the compressor, opening downward, which gives perfect drainage. The cylinder heads are flat, the builders being thereby enabled to reduce to a minimum the clearance between the pistons and heads.

The belt wheel on this compressor is 72 inches in diameter, the unit being belted to a 35 horsepower four-cycle Reeves vertical gas engine, using natural gas as fuel. This engine has two cylinders, and is equipped with an auto mixing valve, which maintains the proper mixture of air and gas under all load conditions. Ignition is secured by means of a magneto. The engine is equipped with two heavy fly wheels and regulation is almost perfect.

The Brine Tank, Etc.

Fig. 3 is a layout of the complete installation. As will be noted, there are four ice-making tanks, each 11 feet 6 inches long by 6 feet 4 inches wide and 53 feet deep, made of ¼-inch steel, each of these freezing tanks containing thirty 330 lb. ice cans. These tanks are arranged in two sections of two tanks each, with a large brine tank placed on one side of same. In this brine tank is immersed an Arctic-Pownall shell brine cooler, through which brine is circulated, being cooled about ⅜ of one degree Fahr. The brine, after passing through the cooler, is distributed through pipe connections to the various ice-making tanks and passes down one side of the tank, around three rows of cans and returns around three rows of cans on the opposite side of the tank. Owing to the extremely rapid circulation and the small difference in temperature of the brine in passing through the tank and back, to cooler, an exceedingly even rate of freezing results in all of the cans.

The brine is circulated through the entire four tanks by means of a 16-inch propeller. The tanks are numbered 1, 2, 3 and 4. Assuming tank 1 to be frozen and ready to harvest, the inlet and outlet valves controlling the cold brine are closed off. The tank is allowed to stand for about an hour to temper the ice. Alongside the inlet and outlet cold brine valves are two smaller valves, termed the warm brine valves. After the tank has been allowed to temper, the warm brine valves are opened, and a 2-inch centrifugal pump circulates the cold brine through the water storage tank, this tank being of such a capacity as to hold sufficient water to fill the thirty cans in one ice-making compartment. The incoming batch of water for the next lot of ice is thus cooled, and at the same time the brine in one compartment is warmed sufficiently to thaw the ice loose from the cans ,the latter

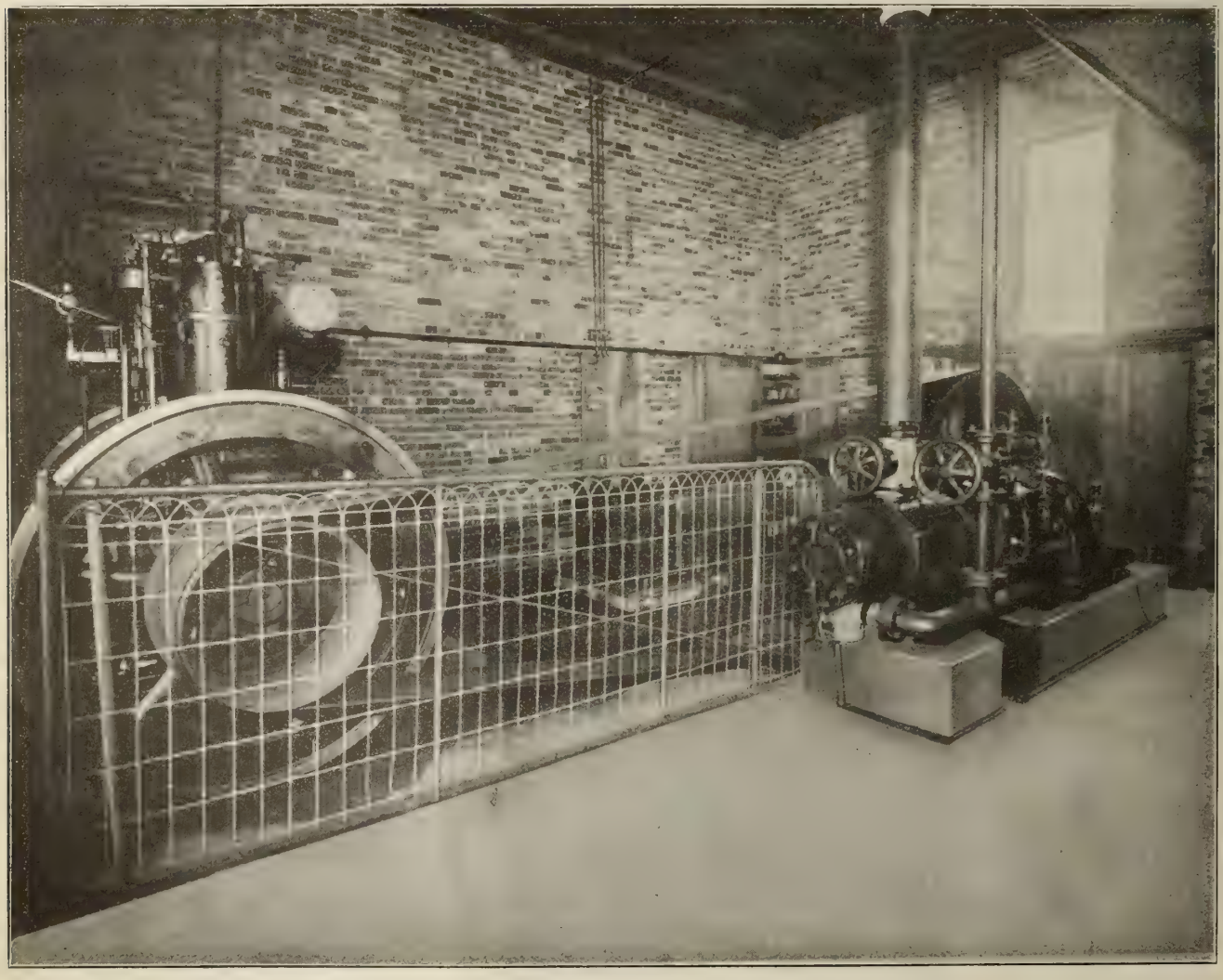


FIG 2.—ARCTIC ICE MACHINE OPERATED BY VERTICAL GAS ENGINE USING NATURAL GAS AS FUEL.

being stationary in the tank. The ice is lifted out of the cans by means of small hooks which are frozen into the side of the block. These hooks are quickly disengaged from the block after it has been pulled from the can. After the ice is all removed from one tank, the cans are refilled with raw water by merely opening one valve, the water entering through connections on the bottom of the tank. Every can is filled to exactly the same height, this being controlled by an overflow located in the "precipitating tanks" located at the opposite end of the ice-making tank, from the shell brine cooler.

The air connection for circulating air to agitate the water during the process of freezing are also connected to the bottom of the cans and are arranged so that by opening one valve, the air is automatically turned on to the entire thirty cans, the same quantity of air being furnished each individual can. After opening the air valve, the warm brine valves are shut off, then the cold brine valve opened, which permits the cold brine to again circulate through the ice-making tanks. The air is admitted to the can through a syphon connection located in the flange on the bottom of can, this syphon being so proportioned that it draws about a gallon of water per minute into each can from the precipitating tanks, while the same amount of water flows out of the can and into the precipitating tanks, thus carrying away all foreign matter from the ice as fast as thrown off, and depositing it in the precipitating tanks. The ice is frozen until there is a hole about half-inch wide remaining through the centre of the block, at which point, by opening one valve on the bottom of tank, all core water is withdrawn. If distilled water is available, this may now be introduced into every can by opening a single valve, in which event the freeze is completed without air agitation. Otherwise the cores are filled with fresh raw water, and the air is permitted to circulate until the block is completely frozen.

The ice-making tanks are carried on concrete piers, on top of which are placed small I-beams, and on top of these is placed a tee bar between each row of cans. The bottom of the tank is about 6 feet 6 inches above the ground, making it accessible for inspection when desired.

Advantages of Raw Water System.

Economy of space and economy of power are two of the prominent advantages of this raw water system. Where cheap fuel, such as natural gas, electricity, crude oil or water power are obtainable this is the logical method of making ice. In Mt. Vernon, which is situated in the natural gas region, this type of fuel is procured at a price which enables the City Ice Delivery Company to manufacture ice at a fuel cost of 9 cents per ton of ice produced. The actual cost of ice per ton on the Arctic-Pownall raw water system was 72 cents. This includes the labor, ammonia, calcium, oil, waste, packing, fuel and sundry expenses.

Only two men are required to run the plant. They pull the ice, look after the machinery, load ice on wagons, and in fact, perform all of the work involved, and have ample time to spare. The harvesting of the ice requires only about three hours of one man's time, out of each twelve hours; and as five tons are harvested at one pulling the attendant has nine hours remaining for any other duties.

The depreciation is exceedingly small, inasmuch as the cans are stationary in

FIG. 4.—10 TON ARCTIC POWNALL RAW WATER ICE FREEZING TANK.

the tank and also because, as the brine is cooled in a shell cooler, the possibility of ammonia leakage and wear and tear on cans is practically done away with.

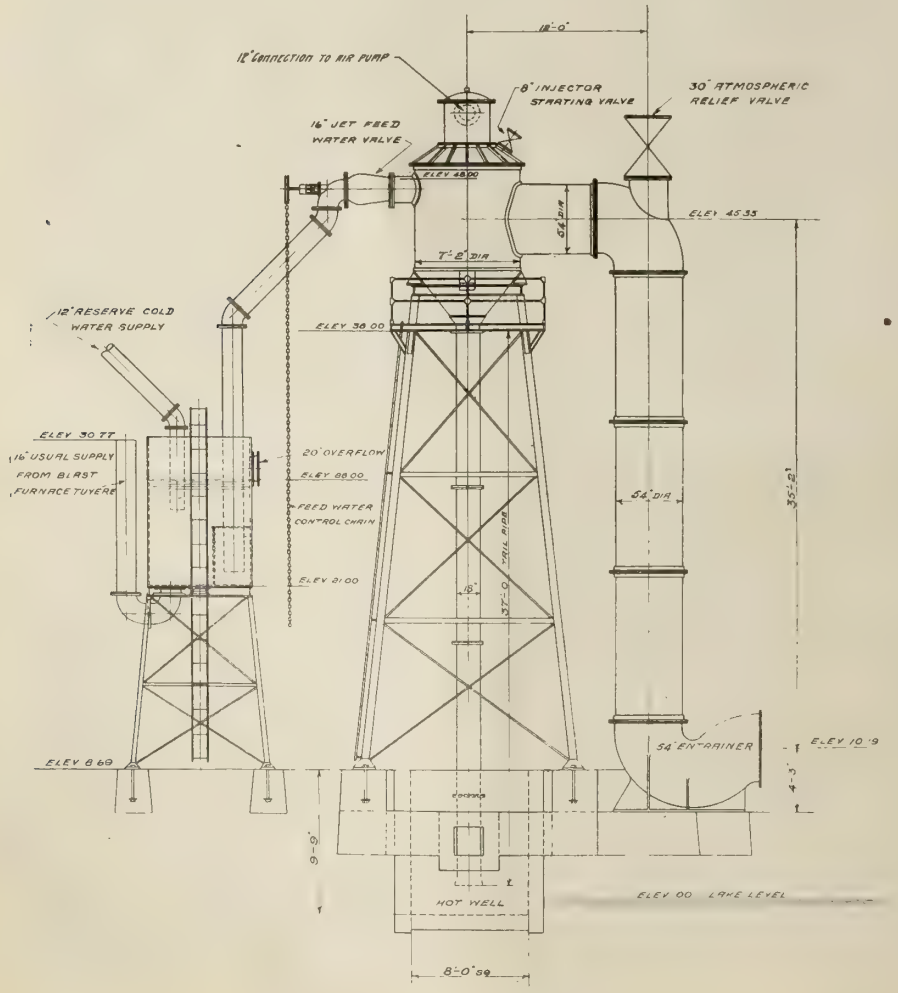
The water circulating pump, brine circulating pump, air blower and the agitator, are all suspended from the wall and operated by belt from one of the fly wheels of the gas engine. The ammonia condenser consists of three sections of 1¼-inch and 3-inch double pipe condensers, 20 feet long by 8 pipe high.

Inasmuch as the Mt. Vernon Ice Company operate both a distilled water plant and a raw water plant, they are particularly well able to make an intelligent comparison of the respective installations. A visit to their plant would undoubtedly prove of much interest to anyone considering the installation of ice-making machinery.

A BAROMETRIC CONDENSER.

AN original arrangement of a barometric condenser is in successful operation at the blast furnaces of the Canada Iron Corporation, Ltd., Midland, Ont. It was designed to utilize the returns from furnace water jackets for the purpose of condensing exhaust steam from turbine driven rotary blowers and auxiliaries in the power station, the location of the condenser permitting of this being done without the use of a circulating pump. After passing through the jackets, the cooling water flows into a trough at elevation 30.77 as seen on the accompanying illustration, and thence it flows by gravity to the condenser supply tank seen on the left. By this time the temperature has fallen to 70 or 80 deg. F., and the water is found to be a satisfactory condensing medium.

In starting up, the vacuum is obtained by means of water delivered through an 8-inch injector starting valve at the top of the condenser, and after the vacuum is formed, the 16-inch jet valve is opened and water drawn from the supply tank into the condenser. This injection valve is of a special design to secure a very easy flow at the point of contraction, thus permitting of a very nice adjustment of the quantity of water delivered to the condenser, and at the same time avoiding the possibility of loss of vacuum due to eddies in this pipe. In case of the quantity of water coming from jackets being insufficient, an auxiliary supply may be obtained through a 12-inch pipe from the Company's elevated water tank.



A BAROMETRIC CONDENSER.

This condensing apparatus was designed and built by The John McDougall Caledonian Iron Works Co., Ltd., in Montreal. It will handle 70,000 lbs. of steam per hour at a vacuum of 27-30 inches, and has been in continuous operation since June, 1912, giving very satisfactory service.

MECHANICAL STOKING OF LOCOMOTIVES.

WITH the rapid increase in size and power of railway locomotives during recent years, the problem of mechanical stoking has engaged the attention of locomotive engineers, especially in the United States, and several more or less satisfactory contrivances have been evolved. Tests made in South Africa have demonstrated the usefulness of such an appliance, and, as it becomes necessary to provide still larger engines, there is no doubt that a suitable mechanical stoker will become more and more a necessity. That now being experimented with on these railways (reports Mr. Hoy) is an advance on any previous type tried, but further improvements are necesary before it can be said to be of practical value. When oil fuel is available at a cost which will compare with coal, locomotive work will be much simplified, and it is hoped that oil will yet be found in payable quantities in Africa south of the equator.

ELECTRICITY IN DAIRY WORK.

THE United States Dairy Co., of Austen, Illinois, handles 3,000 lbs. of milk per hour, and has found electric power economical for dealing with sterilization, bottle washing and refrigeration. The milk is pumped over cooling coils, operated by single 7½ horse-power three-phase induction motors. The bottle washing is operated by 15 horse-power three-phase motors, and the refrigerating machinery by 20 horse-power three-phase motors, these latter also driving compressors and pumps for circulating brine. A 5 horse-power motor pumps the water from the well.

ELECTRICITY FOR STEAM.

One of the largest local traffic systems in the world is that of the Berlin Stadtbahn, which is being changed from a steam operated to an electrical line. In making this change it has been decided to adopt the use of locomotives instead of the more usual scheme of fitting out each car with a motor. The operation of these lines will require 557 locomotives and 700 passenger cars and about 30 other cars.

An Interesting Cold Storage Plant Installation

By "Specialist"

The writer of this article sets forth in an instructive and easily intelligible manner the carefully planned and ample provision made by our large cold storage corporations, to prevent deterioration and premature destruction of perishable products. Cold storage has come to be recognized as a primary necessity of our civilization.

MESSRS GUNNS, LTD., the large West Toronto pork and beef packers, have recently completed the erection of their new city wholesale market and cold storage plant at the corner of Front and West Market Streets, Toronto. The design of the building and the system of refrigeration used brings up some interesting points in cold storage design, and it is the purpose of this article to give a brief description of this plant and point out the features of special interest.

The building measures approximately 100 ft. x 50 ft. and has three storeys and attic. On the first or main floor are the sales room and the beef chill rooms. The second floor has the sharp freezers and coil loft for cooling the chill rooms on the main floor. The third floor is laid out for egg storage and the attic for storage of cases, etc. Figure 1 shows a cross section of the building and gives a good idea of the layout. Fig. 2 gives a view of the sales room which is elaborately finished with tiled walls and oak fittings. The illustration shows the cold storage doors leading to the beef chill rooms which are located on the main floor.

The owners wished to utilize every inch of space on the main floor, and to eliminate the unsightly appearance of a mass of coils in the rooms. They therefore placed their cooler in a pipe loft located over the middle of the room on the next floor, and depend on a gravity air circulation to cool the rooms. The illustration on page 38, gives a view into the pipe loft. The air is cooled here, falls by gravity through the opening provided and displaces an equal volume of warmer air, which rises in the duct along the side walls and in turn enters the coil loft to be again cooled. The circulation isshown by the arrows in Fig. 1.

This method has many advantages over piping directly in the room. A better circulation is obtained and air can therefore be kept more free from moisture. Moreover the pipes can be cleaned of frost at any time without disturbing the rooms. The floor of the coil loft has an asphalt mastic floor with drains to carry away the water.

The sharp freezers on the second floor are cooled by coils placed directly in the rooms which are sufficiently narrow to allow a good circulation of air.

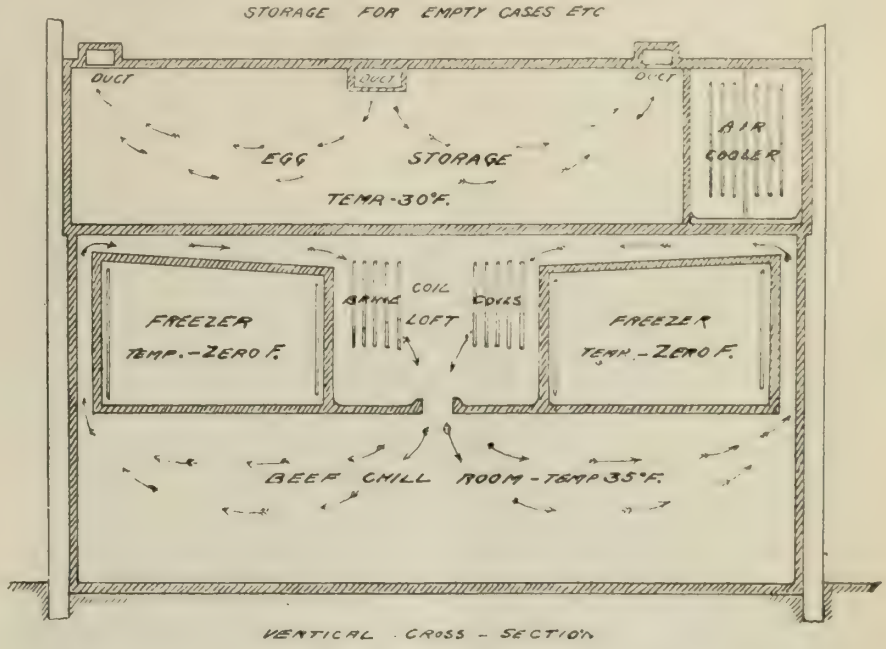


FIG. 1. DIAGRAMMATIC SECTION OF WHOLESALE MARKET AND COLD STORAGE WAREHOUSE FOR GUNN'S, LTD., SHOWING INSULATION IN SHADE. THE ARROWS INDICATE THE DIRECTION OF THE AIR CIRCULATION.

FIG. 2. SALESROOM, GUNN'S, LTD., ST. LAWRENCE MARKET.

FIG. 3. ONE OF THE BEEF CHILL ROOMS, GUNN'S, LTD., ST. LAWRENCE MARKET, SHOWING ENTIRE ABSENCE OF COILS OR DUCTS IN THE ROOM.

Egg Storage.

The third floor is to be used entirely for egg storage, the cooling here being effected by a forced circulation of air cooled in a cooling chamber located along one side of the building. The warmer air is drawn from the rooms through ducts in the ceiling by an electric fan located at one end of the cooling chamber, and after being forced through the brine coils is again delivered in ducts to the rooms. By this method both the temperature and the humidity of the rooms can be positively regulated. This is essential for egg storage in order to secure the best results.

It will thus be seen that three distinct methods of cooling are in use in this plant each especially adapated for the different classes of goods to be stored and the temperature to be maintained.

FIG. 4. LOOKING INTO COIL LOFT OVER BEEF CHILL ROOMS, GUNN'S, LTD., ST. LAWRENCE MARKET.

Care Given to Insulation.

Over 100,000 feet of sheet cork insulation were used in this paint. Messrs. Gunns have had a long experience with insulation and did not spare money on this part of the equipment, as is often done, but used the best obtainable and used sufficient thickness to ensure the maximum efficiency, as may be judged from the fact that at least eight inches of sheet cork intervenes between the freezing rooms and the outside atmosphere.

The floors, walls, and partitions were finished with a smooth Portland Cement finish. The walls being afterwards white enameled. The partitions between the cold rooms are of solid cork construction; no woodwork is used in the insulation except at the doors. The general construction was done by Messrs. Wells & Gray, Contractors, Toronto. The piping was installed by the Canadian Linde Refrigeration Co., of Montreal. The insulation was furnished by Mr. R. Campbell, Cold Storage Builder and Engineer, of Toronto, and erected under his supervision. Brine delivered at a temperature of about 15 degrees F. below zero is the cooling medium.

On account of the limited space available a refrigerating machine could not be installed. Refrigeration therefore is obtained from the plant of the Manning Cold Storage Co., who are located in the next block. The pipes are carried in conduit under the street.

Manning Cold Storage.

It is interesting to note in connection with the above plant that the Manning Cold Storage Co., in addition to cooling about 300,000 cubic feet of their own public cold storage space are supplying refrigeration to about twelve different wholesale produce warehouses surrounding their plant, making in all a capacity approximating three quarters of a million cubic feet of cold storage space.

The plant consists of one double-acting York compressor of 130 tons capacity and one single-acting York compressor of 65 tons capacity driven by electric motors by means of belts. The brine is cooled in double pipe brine coolers having a capacity of 200 tons of refrigeration, the brine being cooled to at least 15 degrees F. below zero.

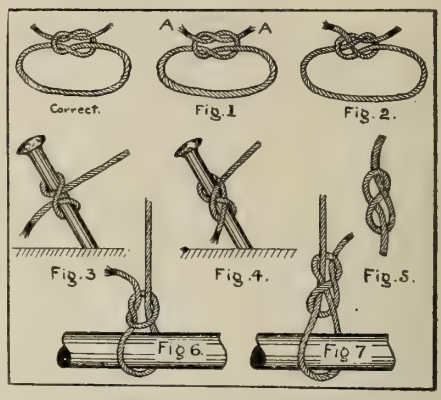
The entire plant was installed by the Kent Company, Limited, of Montreal, Que. Mr. George Kent is the Managing Director of the Manning Cold Storage Co. and Mr. D. Reid is the Chief Engineer.

Printing is necessary to every business above the grade of the applewoman. It is one manufactured product of which a business cannot have too much.

KNOTS AND SLINGS.

By F. R. Parsons.

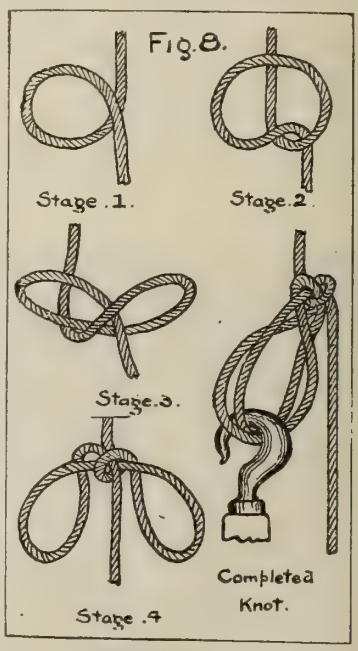
AMONGST the duties of engineers, power-house attendants, mechanics and erectors generally is that of handling awkward-shaped and sometimes



KNOTS AND SLINGS.

cumbrous masses of metal, engines and engine parts, machines, girders, joists, gearing, shafting, etc. There are innumerable little lessons to be picked up in this direction, which, when learnt, are invaluable as time savers and aids to safety. Many lives have been needlessly sacrificed through the snapping of a twisted link in a chain, a faulty knot in a rope, a rotten sling, eye bolt or shackle, or a job slipping out of its tackle when hoisted. Many of these accidents might have been avoided had those in charge known the right and safe way.

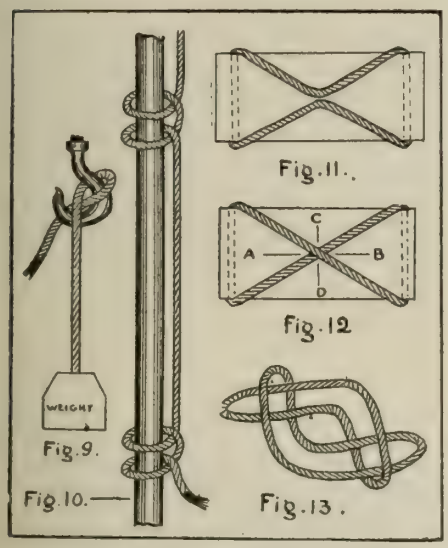
Slings and methods of slinging, the right and the wrong way of tying knots,



KNOTS AND SLINGS.

hitches and bindings, are worth serious attention. Simple knots, simple as they may be in themselves, form the very foundation of that knowledge which

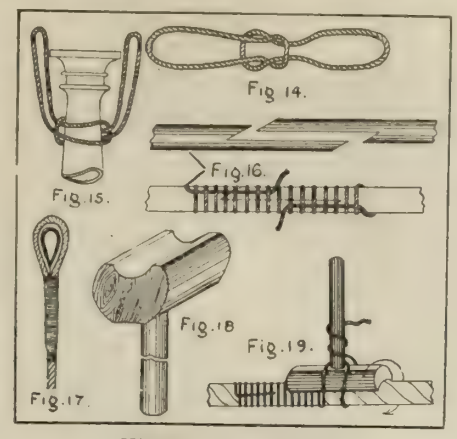
any erector finds indispensable. Fig. 1 shows the right and wrong way of tieing two ropes together, or the ends of one rope in order to make a sling. In the right way no amount of tension will cause the ends to slip, but if wrongly tied, with ends (A) (A) as shown, these will have a tendency to withdraw themselves directly the pull is applied. A variation of this knot is also shown in Fig. 2. **A scaffold knot,** or as it is sometimes termed, two half hitches, is another simple tie, over which frequent mistakes are made. This is a knot useful for various purposes, not the least of which is securing the ends of guy ropes to stakes driven into the ground when erecting high derricks. This application which is the correct method of tying it, is shown in Fig. 3. Fig. 4 is another knot much in favour in some quarters, used for the same purpose, and really an adaptation of the simple twist



KNOTS AND SLINGS.

or figure eight knot in Fig. 5. If you make a slip in the end of a rope like Fig. 6, you are courting trouble; see that the loose end is tied like Fig. 7.

To make a bight in the middle of a rope on which to hang lifting tackle.—If the two ends are engaged and there is some loose rope in the middle, proceed as shown in the first stage of Fig. 8. The second stage shows the single loop given an upward twist, thus forming a double loop—half on each side of the vertical portion of rope. Another twist in the same direction, keeping the loops equi-sided, brings the knot to the third stage. Take the two loops, fold them backwards (from you) and bring them together, and you are then ready to hitch in the hook of the lifting tackle. If this is done correctly you will have a bight which will never slip. It is quickly made and as quickly undone—which cannot be said of the ordinary doubled loop knot when strained tightly through lifting. In all knots of this description the primary object to keep in view is that each tightening curve



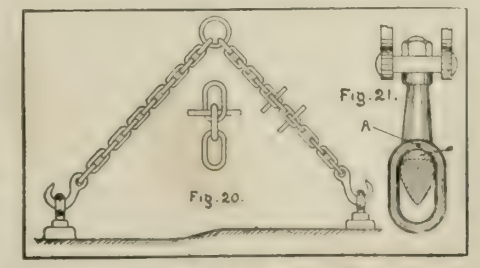
KNOTS AND SLINGS.

or twist of the rope bears on the one which has the most tendency to slip. This is best exemplified by a study of the old and extremely simple loop seen in Fig. 9.

To lift a shaft into perpendicular position.—Some do this by lifting from a collar or a lathe carrier affixed to the top end of the shaft; but an effective and secure way of doing it without the the use of these is shown in Fig. 10.

The Rope Sling.

A sling is a rope with the ends spliced together. It serves a variety of purposes and can be readily adapted to many requirements that a rope falls short of, but one can easily go wrong in using it, simple as it appears, for there are several wrong methods to the one right one. Fig. 11 illustrates a wrong method; the right method being to cross the sling as in Fig. 12. Here again there is a liability to go astray when attaching the hook for lifting. This should never be put through the loops in the direction (A) to (B), but from (C) to (D), and should this appear a trivial detail, try it and note the difference. **A basket hitch** is shown in Fig.



KNOTS AND SLINGS.

13, and its application in Fig. 15, attached for lifting (A) a cast iron column. When one sling is short join two together in the manner indicated by Fig. 14.

In splicing derrick poles, a good plan is to dovetail the poles to be joined, as in Fig. 16, whipping the joint with rope, and to ensure neatness with strength, it should be done as shown. In starting the bind, leave sufficient of the first end of the rope so that it can be pulled tight when wound, and when finishing interpose a stick or hammer shaft between the pole and the last half dozen coils, so that when the latter number is completed, the stick can be withdrawn, and the rope end pushed through. Next, tightly pull up each of these coils singly, finishing off with a stout pull on the rope end. If this is done carefully, the coils being hammered down with a wooden mallet, as you proceed, and the ends pulled tight and afterwards cut off, you will have an excellent splice.

It may be of interest to describe the methods employed when a rope end requires to be bound around a "thimble" and afterwards whipped, as in Fig. 17. This, if done by hand alone, does not result in a satisfactory job, owing to the degree of tightness required. Therefore, it is best to have recourse to the method adopted by many old sailors. They use what is termed a "serving board," as illustrated in Fig. 18. It is made throughout of hard wood, finished with a round smooth handle, and longitudinally grooved to fit the diameter of the rope. The method of using it is shown in Fig. 19. The cord is twisted once round the instrument as shown, the loose end round the handle held lightly, and the board turned in the direction of the arrow. By this means, the whipping can be done quickly, and as tightly as the strength of the cord will allow.

Sling Chains.

If, when lifting with coupled sling chains, you find one end of the sling too long owing to the points of attachment being out of level, don't on any account knot the sling—it is a dangerous practice. Adopt the course shown in Fig. 20. Bolts or pieces of round iron interposed between the links will allow to a nicety for a limited amount of variation, and the work may be slung level without endangering the safety of the links.

Another danger with sling chains is that of using a link too small for the body of the lifting hook—one which does not bear properly but forms an arch. This danger is illustrated in Fig. 21, the tendency of the link being to fracture at (A) when strained.

Care Of Ropes and Slings.

Just a few concluding remarks on the care of ropes and slings. Don't allow ropes or slings to get alternately wet and dry, this rots the fibres. Don't keep ropes in a damp place. Don't permit ropes to get more greasy than can be avoided; remember that a knot

always grips better in a dry rope than a greasy one. Don't put knotted ropes away in the store, always untie them and give them a few blows on the floor in order to straighten out the fibres. Don't allow the ends to become frayed; keep them whipped. Don't fail to protect a rope sling against contact with sharp edges or corners when lifting; interpose old sacking, waste or board. Don't fail to run your eye down a rope always before using. Don't under any consideration, permit a twist or a knot in a chain sling. Don't hitch a chain sling over a girder or joist in such a manner that a part of a link lying horizontally is overhanging the edge, and so has to bear the whole strain of the load. Don't fail to have your chain slings periodically annealed; the links become crystalized through repeated strains in one direction. Finally, don't forget that you can always have your slings tested by competent people at a nominal charge.—From "The Machine Tool Engineer."

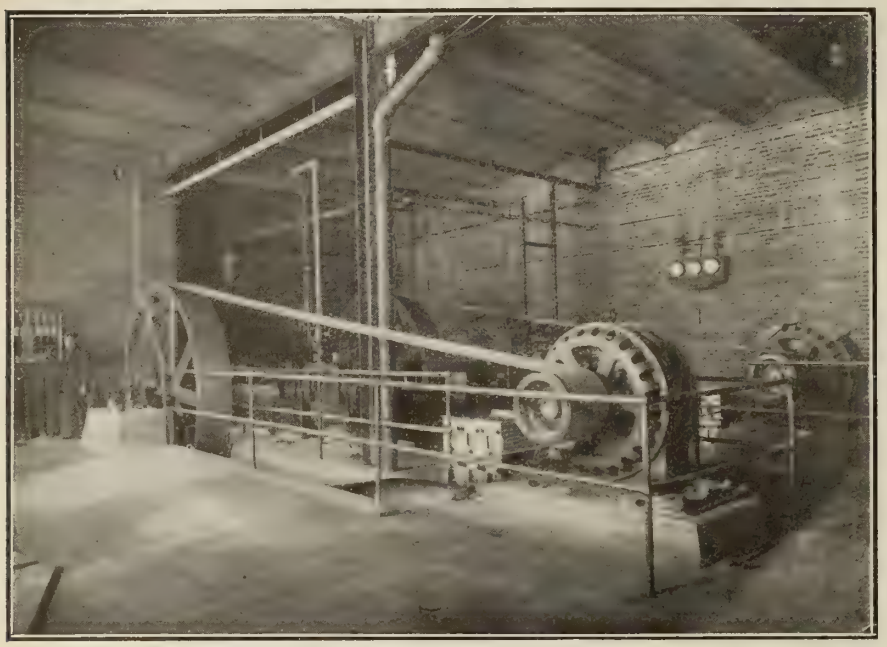


FIG. 1. VIEW IN ENGINE ROOM, ALERTS, LTD., HAMILTON, ONT., SHOWING TWO DE LA VERGNE AMMONIA COMPRESSORS.

ARTIFICIAL ICE SKATING RINK AND ICE MAKING PLANT.

THE accompanying views were taken at the new plant of the well known athletic association, Alerts, Ltd., Hamilton, Ont. Fig. 1 shows the engine room with two horizontal jacketed compressors 13½ inches in diameter by 22 inches stroke. driven by two 75 h.p. electric motors by means of belts. Directly over the engine room there are six atmospheric compressors as shown in Fig. 2. The above supply refrigeration for a skating rink floor 175 feet long by 67 feet wide and also for an ice-making plant of 50 tons per day capacity, and and ice storage room having a capacity of about 200 tons of ice.

The skating rink floor contains 37,000 feet of 1¼-inch brine coils. The brine, which is cooled by expansion coils in the ice-making tank, is circulated by two turbine brine pumps direct-connected to electric motors. Each pump has a capacity of 300 gallons per minute.

The Alerts Company have at present utilized the old Britannia Rink as a skating floor by laying a temporary insulation and waterproofing; but during the coming summer they propose to put in a new Arena building, similar to the one recently erected in Toronto.

Can Ice Plant.

The ice-making tank measures 70 feet by 20 feet and there are four hundred

FIG. 3. OLD BRITANNIA RINK AT HAMILTON, ONT., CONVERTED INTO AN ARTIFICIAL ICE RINK—37,000 FT. OF BRINE COILS ARE USED ON THE FLOOR.

and sixty-four 400 lb. cans. These are handled by a travelling crane with an electric hoist capable of lifting two cans at once. The plant produces ice from raw water and contains an agitating apparatus for producing clear ice. Before the water enters the cans it passes through a forecooler which brings the water to very near the freezing point. The forecooler consists of a pan, pump,

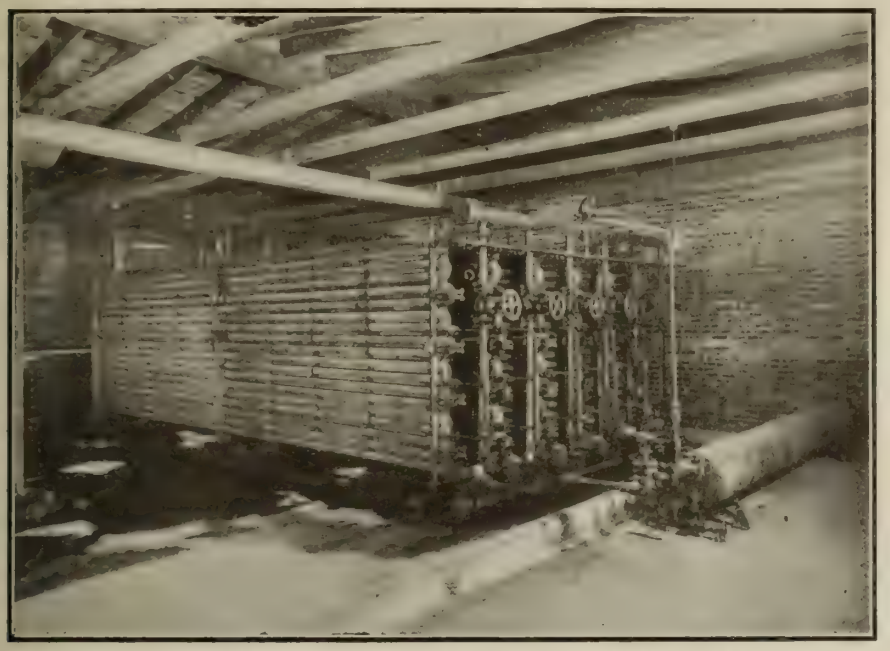


FIG. 2. ATMOSPHERIC AMMONIA CONDENSER AT ALERTS, LTD., HAMILTON, ONT.

and vertical stands of coils, the upper part of these stands consisting of direct expansion coils and the lower part containing the water passing through. The cooling is accomplished by means of the water which continually flows over these coils, it being first cooled by the ammonia section, after which it cools the water passing through the lower section.

The insulation of the ice-making tank and forecooler consists of 4 inches of sheet cork in two layers, embedded in asphalt on the floor below the tanks. The sides of the tanks are insulated with 12 inches of granulated cork. The insulation of the ice storage room consists of 4 inches of sheet cork finished with Portland cement finish.

The entire refrigerating plant was furnished and installed by the De La Vergne Machine Co., New York. The insulation of the tanks and the storage room was furnished and installed by Mr. R. Campbell, cold storage builder and engineer, Toronto, and the general construction of the buildings was carried out by Mr. Wm. Yates, general contractor, Hamilton. Dr. Leeming Carr, of Hamilton, is president, and Mr. Geo. H. Summers is the general manager of Alerts, Ltd.

Since the plant went into operation six weeks ago it is understood to have given excellent satisfaction, no trouble having been experienced in producing an excellent skating surface, whenever required.

INTERNATIONAL REFRIGERATION EXPOSITION.

AS previously announced, an exposition of refrigeration will be held during the third International Congress of Refrigeration at Chicago in September of this year. The arrangements are now complete, and the association thoroughly organized for holding this exposition in the amphitheatre at Forty-second and Halsted Streets, the largest building of its kind in Chicago. It is equipped with trackage connection with all of the railways entering the city. Everything pertaining to refrigeration will be exhibited, cars, machinery of all sorts in active operation, fruits, game, poultry, meats, vegetables, eggs, butter and cheese. With the 500 or 600 delegates from Europe and South American countries and kindred conventions of American ice makers, meat packers, poultry, game, butter and egg people and others, nothing equaling the importance of this exposition has been undertaken since the World's Fair.

The officers and directors are: President, pro tem., William L. Wagner; vice-president, Frank L. Nickerson; general manager, William E. Skinner, with office at 819 Exchange Avenue. The Board of Directors includes the above officers, together with Theodore O. Vilter, John S. Field, F. S. Pilsbry, Arthur Meeker, H. C. Gardner, C. M. Seerist, George E. Haskell, A. D. White and H. W. Hart.

THE MODERN COOLING TOWER.

By B. Franklin Hart, Jr.

THE surface of the field of the modern cooling tower has scarcely been scratched. Many, in fact the majority of prospective and operative ice manufacturers think a natural water supply for cooling purposes is almost imperative. Plants have been located on the banks of rivers, lakes, etc., where real estate values are higher, in most cases, than inland locations. Wells also have hitherto been utilized operating with deep well pumps or air lift systems. Again, in cities, the water is often taken from the mains at considerable cost.

Deep Well Systems.

With the advent of the modern highly efficient, medium-priced cooling tower all this is changed. The prospective ice manufacturer may locate his plant at the point most convenient for delivery purposes, and where land costs are reasonable. He need not consider the question of wells which are usually expensive to install, and what is more, costly to operate. In addition to these objections, they very often fail to produce the quan-

FIG. 4. A TYPICAL ARTIFICIAL ICE STORAGE ROOM.

tity or quality of water desired. Victims of well failures are legion and are spread over the entire country. The writer knows of one concern that spent thousands of dollars over a period of ten years, after which experience a cooling tower was installed with the result that three years have now elapsed during which time there have been no water troubles or shortage whatever.

Operating Cost Comparison.

The consumption of coal to provide the necessary steam to operate a deep well pump or air lift system becomes a considerable item where the exhaust steam is not entirely utilized. Let us make a comparison in the cost of operating between an ice plant using a deep well or air lift system to provide cooling water for the condensers, and a plant using a cooling tower with a centrifugal pump discharging the heated water to the tower.

In the case of the plant pumping its water from a considerable depth, the steam consumption in the pumps or air lift system would average about 150 lbs. of steam per horsepower per hour. To turn 150 pounds of water into steam requires about 22 pounds of coal, figuring an average good grade of coal having sufficient calorific value to evaporate seven pounds of water per pound of combustible. In the cooling tower plant, the centrifugal pump may be run from shafting which is operated from the main engine, where a horsepower costs from 20 to 30 pounds of steam per hour or an equivalent of four pounds of coal. If the centrifugal pump is driven by an independent steam engine, the consumption of steam per horsepower will be in the neighborhood of 40 pounds or the equivalent of six pounds of coal. We thus find in comparing, that the deep well or air lift system costs about 22 pounds of coal per horsepower per hour to operate, while the centrifugal pump supplying the cooling tower requires but from four to six pounds of coal per horsepower per hour. This is a striking fact not always carefully considered.

Water Quality Feature.

Aside from the question of cost of operation in connection with deep well or air lift pumping systems is the question of the quality of the water found. Where this water carries the carbonates of lime and magnesia it becomes a source of nuisance and trouble from the deposits made in the shape of scale, not only in the boilers, but in all the piping and apparatus through which it runs. The writer knows of a case where the water was so heavily laden in this manner that it became necessary to do away with the discharge piping from the condensers and substitute therefor open wooden troughs. After a time it was discovered that the sewer into which this water was discharged was becoming filled with the scale when the city authorities stopped the operation and the plant owners installed a cooling tower.

A peculiar situation, and one never before encountered developed in an ice plant on the outskirts of Brooklyn, N.Y., some time ago. Sewers had not been installed as far out of the city as the plant location. There was an ample supply of water and of good quality. The water was very close to the surface of the ground which was a loamy sand. It was pumped from the ground and after having run over the condensers was discharged into the open lots, adjoining the power house. This water gradually seeped, and after a time saturated the ground in the vicinity of the plant and presently the neighboring wells were supplying hot water. This arrangement might have been excellent on Mondays for laundry purposes, but as a thirst quencher for the remainder of the week, it was not popular. Complaints were made at the ice plant when the cause was located. The company with the modern "public be pleased spirit" remedied the trouble by installing a cooling tower.

Rivers, lakes or ponds often provide water that is exceedingly muddy and gritty. This water cuts up the pump chambers and makes the pumping system a source of constant annoyance and repair. With the installation of a cooling tower under these circumstances, the dirt and grit are soon deposited on the cooling surface of the tower which should be designed so that there are no perforations to fill up or clog. After a trip or two through the tower, the water is clean and the small amount necessary to make up the evaporation losses will not be sufficient to cause trouble.

Fan Versus Open Design.

The cooling tower must first of all be efficient and thoroughly so under all conditions; secondly, it must be built substantially; thirdly, it must provide against spray losses, and under the first heading we might take up the question of the "fan" tower versus the "open" or "natural draft" design.

The earliest towers of which we have any knowledge were very crude affairs where the heated water was broken up by layers of brush over which the water was distributed in a crude fashion. Following this came the German type, called the "Gradir-Works" tower. This design merely provided a great surface of wood work shaped somewhat like a flower stand over which the water, having been discharged at the top, would flow in a thin film down the several steps and be caught in a reservoir at the bottom. This design of tower required a tremendous surface in order to get any sort of efficiency and has been practically abandoned in recent years.

When cooling towers began to find users in the cities where space was an important item it was thought necessary to provide a specified quantity of air, which was usually impelled upward vertically through a shell where it came in contact with the falling heated water. The water was exposed in various ways. For instance, one design made use of galvanized wire closely meshed, over which the water trickled in a thin film. Another design made use of short length and short diameter sections, either of steel or of pottery, which were laid in layers with "broken" joints over which the hot water trickled on its way to the bottom of the tower, while the impelled air currents were forced up against it in a vertical direction. Still another design makes use of strips of wood tied together with wire, very much like a kind of fence construction. All these designs are intended to divide the water into thin films and thus get a great exposure to the air currents.

In the fan tower, all the air must necessarily enter through the fan opening and as it makes it journey up through the tower the vapor load is increased at each step. Every foot of the distance takes away from its cooling efficiency and after it has attained its full load of vapor, it is of no further use whatever as a cooling agent. About 90 per cent. of the cooling work of a tower is brought about by evaporation. When heated water is brought into contact with the atmosphere, the vapor which develops immediately is carried off by the air currents. New vapor is quickly formed, which is in turn carried off. This continued operation is what we call evaporation. When the air is dry or as we say when the humidity is low, it will carry off vapor in large quantities and at a rapid rate and is a good cooling agent. On the other hand, when the air is moist, or, as we term it, the relative humidity high, it will carry off but little vapor, since its maximum capacity of 100 per cent. humidity brings precipitation, and, therefore, limits the load of vapor.

In the fan tower all the air being taken through the fan opening at the bottom of the tower is not reinforced by additional air during its trip through the tower, so that the lower part of the tower may be highly efficient, while under high humidity conditions the higher part of the tower will be absolutely valueless. On the other hand, the open tower furnishes the same quality of air at the top as it does half way up and at the bottom, making each square foot of cooling surface equally efficient.

In the fan tower, as pointed out above, the lower surface may be efficient, while under adverse conditions

two-thirds of the surface may have no efficiency whatever. This is the reason why "natural draft" or "open" towers show better cooling results when properly designed than anything offered by the "fan" or "forced draft" tower. The "fan" tower has no advantage whatever over the "open" tower, except in the matter of space requirements, and the only excuse in these days for a fan tower is where the proposed location would be blanketed entirely by surrounding buildings or where it would be necessary to place the tower in a very small space. Another point in favor of the "open" tower is the absence of moving parts of any kind, and, consequently, the elimination not only of original cost, but also the continual repairing expenses which are always associated with anything that moves.

The Cooling Range.

We may next look into the question of cooling range. Where the duty is that of cooling the circulating water for ammonia condensers and a proper quantity of water is circulated (a common ratio being three gallons of water per minute per ton of refrigeration per twenty-four hours), the water leaving the condensers will not exceed 100 degrees F. in the hottest weather. From this initial temperature, a well designed tower should cool the water to a point within about 5 degrees of the temperature registered by the wet bulb thermometer during hot weather. The theoretical limit for cooling is the temperature registered by the wet bulb thermometer, but the point 5 degrees above the wet bulb reading is sufficiently close for high efficiency. First class results may be obtained with the circulating water going to the ammonia condensers at 85 degrees if the quantity is sufficient. For steam condensers, the problem is somewhat different, and where the condensers are of the submerged type or of the surface type, operating under no-vacuum conditions, the temperature at which the water would go to a cooling tower would range from 160 to 180 degrees F. during hot weather, depending on the quantity of water circulated. A well designed cooling tower would cool this 180 degree water down to about 100 degrees during hot weather. This is ample and will allow any plant to operate up to its full capacity. For ice making plants two towers were formerly used, one for the ammonia condenser, and one for the steam condenser, but the writer has found that with sufficient water first-class results may be obtained in one tower. For instance, in a tower recently designed the problem was as follows:—

One Cooling Tower Installation.

An ice making plant having a capacity of 200 tons of ice per twenty-four hours, was pumping salt water from the river about 500 yards away. The pumping plant was a source of constant annoyance and expense, and the cooling tower was turned to for relief. For this job, we proposed to install a tower having a capacity of 1,200 gallons of water per minute, or six gallons per ton of ice. The tower was placed above the ammonia condensers and the steam condensers were in turn placed below the ammonia condenser. 200 tons of ice per twenty-four hours means the evaporation of about 17,000 pounds of water per hour in the boilers, which amount, when compared with 1,200 gallons per minute (or 600,000 pounds per hour), makes a ratio of 35 to 1 for the circulating water. This quantity of water, when condensing 17,000 pounds of steam per hour, will leave the steam condensers at about 130 degrees F. The boiler feed supply is taken from this, and is estimated at say 80 gallons per minute, allowing for leaks, etc.

The loss of water in the tower through evaporation was placed at 10 per cent., making a total consumption of water of 200 gallons per minute. This is taken from the city mains, and in hot weather will have a temperature of about 70 degrees F. The 1,000 gallons per minute from the steam condensers is discharged into a receiving tank placed below the steam condenser floor. The "make-up" water is also discharged into this tank. The water in the tank will, therefore, be made up of about 1,000 gallons per minute at 130 degrees F. and about 200 gallons per minute at about 70 degrees F., making a mixture of 1,200 gallons per minute at about 120 degrees F. to be pumped back to the cooling tower. The cooling tower will cool this water to within about 8 degrees of the temperature registered by the wet bulb thermometer. We see from the foregoing that an ice plant, no matter how large, may be cared for as far as the circulating water for ammonia and steam condensers is concerned, by a single tower if properly designed.

The cooling tower problem has been clearly solved and the ice maker, cold storage proprietor, brewer, power plant owner, and all users of water in quantity for cooling purposes may turn to the modern cooling tower with perfect confidence. From a paper read at the Southern Ice Exchange Convention, Birmingham, Ala.

A 6-TON TRUCK MAKES A HEAVY HAUL.

THE 6-ton motor truck shown herewith is fitted with an interesting type of hydraulic transmission. It is known as the La France hydraulic truck. The motive power consists of a gasoline engine directly connected to a pump which has five cylinders arranged radially around a common crank shaft. This pump delivers oil to two oil motors of somewhat similar design to the pump, each motor being connected to one of the rear wheels by a chain.

Forty-six tons were recently hauled by one of these trucks up Broadway, New York to 59th street and across 59th street to 67th street and the East River.

VIEW OF THE LA FRANCE TRUCK WITH ITS OWN LOAD AND THE TRAILING LOAD.

The truck, itself weighing 4½ tons, was loaded with six tons of boiler fittings; while behind was attached a wagon weighing 12½ tons and carrying a boiler weighing 23tons, which came from the Municipal Building at City Hall. At least twenty horses, it is said, would have been required to haul this load. These twenty horses would have occupied at least 250 feet on the streets of the city and would have effectively blocked all traffic while they were passing. The La France truck is only twenty feet long, so that there was over 230 feet of street space saved. Further than that, the run was made with the truck in probably half the time that horses would have taken.

This run tends to prove that the hauling of heavy materials through the streets of large cities by motor trucks, either with or without trailers, is an advantage both to the user of the truck and to the general public. It is claimed that, but for the hydraulic transmission of the La France truck, it would have been impossible to start and stop with such a heavy load, without straining some of the parts of the truck. In fact it is said that one cannot overstrain this truck, because the pump is fitted with a relief valve which acts before the car gets overloaded.

The La France hydraulic truck is handled by the Hydraulic Truck Sales Co., 1777 Broadway, New York.

S. F. BOWSER & CO. CONVENTION.

THE annual convention of salesmen of S. F. Bowser & Company, was held in Toronto on January 13, 14, 15. The convention wound up the most successful year in the history of its organization. An address of welcome opened the convention, delivered by S. F. Bowser, president, who thanked the members of the staff for having made the success of the past year possible. Announcement was also made that, owing to the enormous growth of Canadian business, it had been found necessary to increase the size of the Toronto plant and a $40,000 addition would be proceeded with at once. The first days programme was as follows: Address of Welcome, S. F. Bowser, president; Response from salesmen, H. J. Jeavons; Sale of cut 241, J. A. Forsythe; Discussion, F. C. Sears; "Meeting Obstacles," F. Clayton; Discussion, J. W. Merickel; "Our Private Garage Work," A. E. Moffatt; "Will Not Buy, Going West," W. Y. Robertson; Discussion, A. McIntosh; "Importance of our Paint Oil Line," W. R. Hance, Canadian Manager; "Technical Knowledge," T. H. Rhodes; Discussion, F. Clayton. The programme for Tuesday, January 14, included talks on the following topics: "Co-operation," S. B. Bechtel, Assistant General Manager; "Importance of our Coal Oil Line to Salesmen," W. N. Denning; Discussion, J. B. Harley; "Our Dry Cleaning Line," H. E. Bleeker; Discussion, A. Anderson; "Systematic Working of Territory," W. G. Zaht; "The Prospect who knows all about the Bowser," E. J. Murphy; Discussion, A. L. McIntosh; "Justifying the Initial Cost," T. F. Horan; Discussion, F. C. Potter; "Insufficient Information From Salesmen," H. Christie.

At 8 p.m. a banquet was held at the King Edward, when the following toast was honored: "The King"—Hands Across the Sea, S. F. Bowser, president; "Our Firm," S. B. Bechtel, assistant general maanger, T. H. Rhodes; Solo, Harry Christie; "Our Sales Organization," W. G. Zahrt, general sales manager, and A. E. Moffatt; Solo, F. A. Thompson, Canada, and Jno. A. Cooper; Character sketches, F. Clayton. The souvenir menu was gotten up in a very attractive manner by the Bowser Press.

A very interesting feature of the convention was the presenting of the loving cup which was won by the Toronto branch. This cup is presented to the branch doing the largest volume of business during the year, and the competition is open to Canadian and United States branches.

The Toronto branch feel confident that they will be able to hold the cup as prospects for this year are very bright, and additional salesmen are being added to the staff. The three men in the group photographed with hands on the cup are officers of the Pacemakers Club from the Canadian field. Election to Pacemaker's Club is a reward for high standing in sales and is an honor greatly desired by salesmen.

W. R. Hance is manager of the Toronto District, winners of the 1912 Loving Cup Contest.

The convention was brought to a close on January 15, and the staff departed brimful of enthusiasm regarding the prospects for the present year. The following attended the convention: S. F. Bowser, president; S. B. Bechtel, assistant general manager; W. R. Hance, Canadian manager; J. A. Forsythe, assistant Canadian manager; E. Cummings, factory manager; A. Anderson, W. L. Anderson, H. Beique, H. E. Bleeker, F. Clayton, H. Crepin, W. N. Denning, H. A. Desparious, J. W. Edwards, George Harley, J. B. Harley, W. Hickingbottam, T. F. Horan, H. J. Jeavons, E. J. Lessel, J. W. Merickel, A. McIntosh, A. Leo, McIntosh, W. R. McCaughy, A. E. Moffatt, E. J. Murphy, N. Paquette, F. C. Potter, T. H Rhodes, W. Y. Robertson, F. C. Sears, R. H. Williams.

A group photograph taken at the annual convention of S. F. Bowser & Co. at Toronto. Mr. W. R. Hance, Manager of the Canadian branch is the third from the left in the front row.

GAS AND OIL ENGINE PROGRESS

A record of principles of design, construction and achievement in a rapidly developing sphere of power generation.

HORIZONTAL DIESEL ENGINES.

DIESEL engines, states a contemporary, are so commonly of the vertical type that the claims of the horizon tal type have been very much overlooked. Vertical engines occupy less floor space and are perhaps less liable to cylinder wear and consequent loss of compression, which latter would be fatal. On the other hand, all engines require careful attention, and this is more than usually true of the Diesel type. Up to a certain point a horizontal engine is much easier to clean, inspect and overhaul than a vertical engine, and to this extent the horizontal Diesel oil engine deserves more consideration than it has received.

This advantage of the Diesel engine is, however, not quite so marked with multiple cylinders as when the engine has only one cylinder. A certain amount of gear is essential to each cylinder. In the case of a vertical engine there are three lines of approach—back, top and front; but in a horizontal engine there are only two, unless the cylinder is set over a well in the foundations. For single-cylinder engines this defect is overcome by using the flanks of the cylinder, and there seems to be strong reasons for thinking that the single-cylinder Diesel engine should be built in the horizontal as well as the vertical form. Several such have, indeed, been set to work on the Continent of Europe, and one or two with multiple cylinders, but in this latter type the cylinders are arranged in tandem pairs with plenty of room on both sides, and not on the side-by-side plan universal in the case of vertical designs.

REGARDING A DIESEL ENGINE BREAKDOWN.

PARTICULARS regarding the breakdown of a Diesel engine have recently been given in the "Vulcan." The engine was of 236 horse-power, running at 180 revolutions per minute. The accident occurred by reason of the seizure of the piston in the cylinder nearest to the fly-wheel, the resulting stresses causing the breakdown. Our contemporary states that the Diesel engine has many risks peculiar to itself, in addition to those common to the ordinary gas engine, which makers must overcome, if its reliability is to equal that of the steam engine. The danger of the pistons seizing in the cylinders seems to be an ever-present one, owing to the fact that the cylinder temperatures are very high, and the clearances must be made very small in order to attain the high compression necessary. The correct sizes can only be obtained by the lengthy and oftentimes costly method of trial and error, but in view of the increased prices which will undoubtedly be asked in the near future for oil of all kinds, the makers of the Diesel engine must make every effort to enhance its reliability.

ANOTHER TRIUMPH FOR THE INTERNAL COMBUSTION ENGINE.

By H. A. Wilson.

THE places in which the internal combustion engine can be utilized seem to be unlimited. Every little while some new situation presents itself and the gasoline engine seems to be especially adapted for use under the peculiar conditions set forth herewith. The case of a ferry on the Bay of Quinte, Lake Ontario, is only one of a thousand instances where history has repeated itself. However, the story is an interesting one. In this ferry boat, several drives were used, each an improvement on the previous one, the last being an up-to-date gasoline equipment. For years this ferry has been operated between Glenora and the historic village of Adolphustown. The first type of boat was a horse ferry. Two horses through the medium of tread mills were the prime movers in this primitive ferry. The paddle wheel was situated at the stern.

The trade increased, however, and demanded a boat more conveniently operated. A new ferry was built having two side paddle wheels which could be operated in either direction. This ferry was also driven by tread mills. By means of gears the power was transmitted to the wheel shaft. The reverse motion was accomplished by introducing an idler gear in the gear train. This boat did not fill the demands of the increasing traffic and was replaced by a steam ferry of the catamaran type, that is, one consisting of two separate hulls placed parallel to each other, a few feet apart, and decked over. The engine was mounted on one hull and the boiler amidships as shown in Fig. 1. The paddle wheel was between the two hulls, about amidships. The engine was of the stationary, horizontal, slide valve type, and steam was not used expansively. The engine had to run both ways, but its original design as a stationary unit admitted of operation in only one direction. However, reversal was accomplished without the use of an additional eccentric, as is seen in

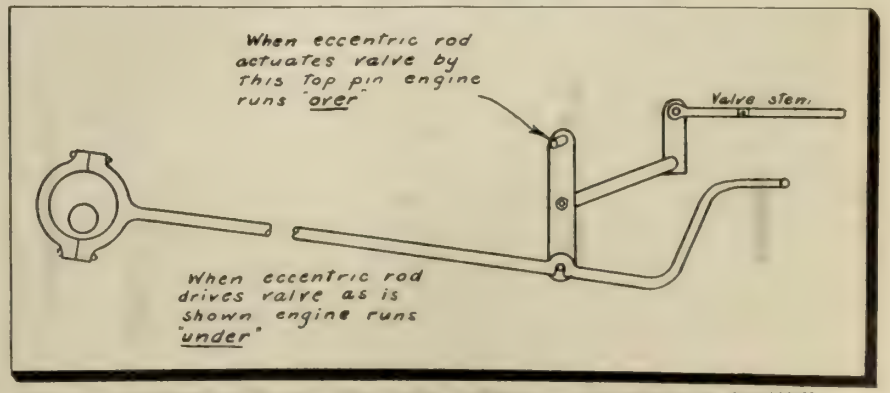

When eccentric rod actuates valve by this top pin engine runs "over"
Valve stem
When eccentric rod drives valve as is shown engine runs "under"

FIG. 2. ANOTHER TRIUMPH FOR THE INTERNAL COMBUSTION ENGINE.

Figure 2. The link motion there shown could be utilized only because of the fact that the steam was used non-expansively.

This engine propelled the ferry for years and gave excellent satisfaction, but was eventually superannuated and a gasoline engine installed in its place. The latter is also of the stationary type, being of the ordinary single cylinder, horizontal design, having a fly wheel on either side of the main bearings. It is rated by the builders at 20 h.p. The bore is 10 inches, the stroke 17 inches and its speed 250 R.P.M. By means of a simple adjustment of the governor, it can be operated with excellent economy at speeds considerably less than this. The engine is connected up to the paddle wheel in rather a unique manner. It is placed where the old steam boiler originally stood, as shown in Figure 3. The crank shaft extends through the fly-wheel and has an extension of several feet coupled to it. Two friction clutch pulleys are mounted on this shaft and between them is a yoke to which a wooden lever it attached. When this lever is vertical, both clutch pulleys are released and the shaft runs idle. If pushed to the right, the right pulley clutches the shaft and drives, and vice versa. These pulleys are both belted to a counter-shaft, one by a straight belt, and the other by a twisted belt. On this counter-shaft are placed two wooden pulleys, and this shaft is connected to the paddle wheel shaft by means of two sprockets and a heavy chain. Control of the equipment is thus extremely simple.

This mechanism and transmission have been in operation for several months in which time they have been given a thorough test in all sorts of weather and have proved entirely satisfactory. In fact this drive has proved itself to be far ahead of any of its predecessors. The operating expense is just about half the cost of steam, for two reasons. Firstly, because of the extravagant and prodigal use of steam, and secondly, because of the peculiar operating conditions. The ferry makes no regular trips but remains on one shore until a vehicle arrives for passage across the Bay; or she is signalled that a vehicle awaits her arrival on the opposite shore. Thus she may run constantly for two or three hours, or may remain idle for as long. At best the traffic is intermittent and not conducive to economical operation under steam. The actual distance between the two landings is about a mile.

THE MODERN GAS PRODUCER.

THE development of the gas producer formed the subject of a paper read before the Liverpool Engineering Society, recently, by Mr. F. Fielden. He said that the gas producer method of combustion is most commercially profitable with light moist fuels. He gave examples where spent tan, containing as much as 50 per cent. of moisture, is used in producers, the fuel being first gasified and the gas burnt in boiler furnaces. Such a plant has been working for some years at a tannery in Runcorn, while a more recent installation said to be the largest in the world for dealing with this waste product, is one of 700 horse-power now being erected at Ditton, in which 300 horse-power is to be used for power purposes and 400 horse-power for combustion under existing steam boilers. With a moisture content of 50 per cent., the consumption per brake horse-power hour amounts to approximately 3½lb., and the gas produced with this weight of spent tan is from 70 to 80 cubic feet at approximately 125 to 135 B.Th.U. per cubic foot on the lower scale.

On the subject of the application of gas power to marine purposes, the author said that the successful gas producer should be (1)—of the bituminous type, (2)—with open-hearth firegrate, (3)—with cascade type of washers and coolers in which no loose pieces of any description such as coke, earthenware, &c., are employed, (4)—with rotary tar extractors, and (5)—having the gas pipe connections to the engines so arranged by means of suitable cocks that when the gas is suddenly cut off from the engines, the same movement of the valve lever by-passes the gas to a boiler adapted to both gas or solid fuel firing, the boiler being used to supply steam for working the winches, etc.

OPERATING ENGINEERS' LICENCES.

A FEW weeks ago, a deputation from the Canadian Association of Stationary Engineers waited on the Minister of Agriculture for the Province of Ontario, and pressed anew their desire to have the existing Act referring to their calling, amended, so as to make available and necessary the possession of licenses of different grade or degree.

Personal

Mr. Fox, resident of Minneapolis, but formerly of London, Eng., was made water works engineer of Calgary on January 27.

Mr. G. W. Smith, president of the Engineering Equipment and Supply Co., Montreal, entertained his staff at dinner on Thursday night, Feb. 6.

Mr. John E. Gow, of Kingston, district inspector of Inland Revenue, has been appointed inspector of bonded manufactories for the Dominion.

H. H. Wilson has been appointed Toronto Assistant-Inspector of Gas and Electricity, and **E. Little** to a similar position at Fort William, by orders in Council.

Mr. P. H. Kemble is severing his connection with the Toronto Electric Light Co. Mr. Kemble has accepted the position of manager of the commercial department of the Union Gas and Electric Co., Cincinnati.

W. M. B. MacDonald, electrical superintendent of the Cape Breton Electric Co., was married in Montreal recently to Miss Hebden, the daughter of a Montreal banker. Mr. and Mrs. MacDonald will make their home in Sydney.

E. J. Phillips, of Berlin, has been appointed manager of the Brockville light and water department, to succeed C. T. Wilkinson, who has retired to go into business. Mr. Phillips' salary will be $2,500 per annum.

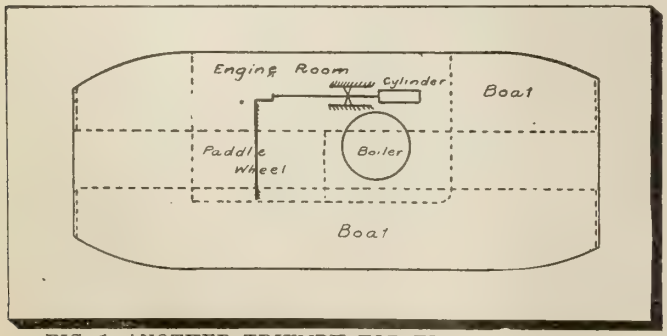


FIG. 1. ANOTHER TRIUMPH FOR THE INTERNAL COMBUSTION ENGINE.

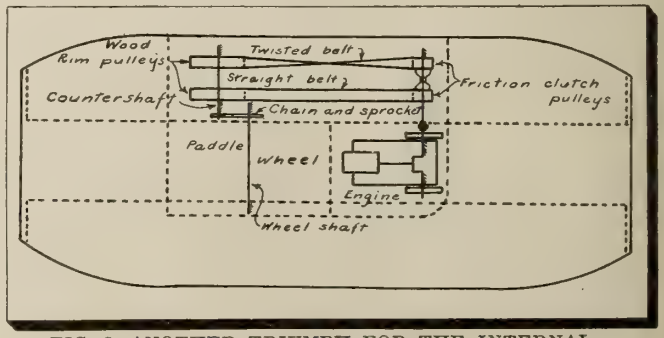


FIG. 3. ANOTHER TRIUMPH FOR THE INTERNAL COMBUSTION ENGINE.

ELECTRICITY AND HYDRAULICS

This department is intended, in addition to individual treatment, to feature the close relationship existing between electricity and hydraulics in the power and light field.

STEAM AND ELECTRIC DRIVING.

AN investigation carried out in the United States by the Worcester (Mass.) Electric Light Co., in regard to the relative cost of operating a small machine shop by steam and electricity, has shown a saving of $143 yearly in favor of electric driving. Previous to the conversion, a steam boiler and engine, the cost of which was $1,500, supplied an average of 15.3 h.p., and, including wages, fuel, water, interest, depreciation, and repairs, the cost of maintenance was $1,664 a year. In place of this plant, four electric motors of a total of 30 h.p. were installed at a cost of $507, the boiler, which had cost $600, being retained for heating purposes. Including interest, etc., energy, coal for heating, and labor, the cost of operating by means of the electric drive amounted to $1,521 a year.

HYDRO-ELECTRO IN SWITZERLAND.

THE past fifteen years have witnessed a remarkable advance in hydro-electric power development in Switzerland, says the American Vice-Consul at Zurich in a current report, and stations for the production of electrical energy have sprung into existence in all parts of the country, following the rapidly increasing use of electricity and the demand for cheaper power. In 1911 there were 783 electric power plants in operation in Switzerland, and as marked evidence of the rapid increase in this branch of industry in Switzerland, he points out that there was an increase of 108 electric power works in one year.

Some of the most important sources of water powers are rivers supplied by glacial waters, but as at certain seasons of the year these are very low, many of the hydro-electric works are obliged to have auxiliary steam or gas engines. The Rhine River, for instance, at the point where the important Laufenburg plant is being constructed, discharges 132,000 to 176,000 gallons of water per second, but this amount is reduced to about 60,000 gallons during nearly two months each year. It is estimated that Swiss waters are capable of furnishing energy to the extent of 2,000,000 horse-power, and of this amount 500,000 to 700,000 horse-power is now harnessed and in actual use.

RHEOSTAT FEATURE.

FOR testing a large sub-station storage battery at St. Louis it became necessary to provide a rheostat capable of dissipating continuously the power represented by 5,000 amperes at 300 volts. For this purpose a rheostat was designed by Mr. K. H. Hasen, electrical engineer of the Union Electric Light and Power Co. It was of the water-cooled pipe-grid type, in which the iron pipe could act as the conductor while being cooled by a flow of water. Preliminary experiments and calculations indicated that about 600ft. of 2in. pipe would be required. Forty-seven 20ft. lengths of double-strength 2in. pipe were coupled in 40ft. pairs and connected by standard pipe returns, making a total length of 569ft. of pipe. It was soon found that the rheostat could not be cooled sufficiently by passing water from end to end through the 569ft. of pipe, so it became necessary to tap holes in the return fittings, threading one set and inserting nipples to hold the hose connections to the manifold water supply pipe. From the other ends the water was allowed to escape and waste.

TRANSFORMERS.

TRANSFORMERS have been constructed with thin plates of copper and aluminum, inserted between the primary and secondary coils, which project into the surrounding air, and very effectively increase the cooling surface of the transformer. It is pointed out that the adoption of this construction has considerably widened the sphere of application of the air-cooled transformer. Equations have been developed for determining the necessary proportions in a design which will give the cheapest or the most efficient or the lightest transformer with a given temperature rise.

AFTER ELECTRIC SHOCK.

IN dealing with persons suffering from electrical shock, if the victim remains in contact with the circuit, his body must not be touched by the rescuer, but the latter may pull him out of contact by hauling on the clothing, or he may take off his own coat, insert his hand in the sleeve and then handle the victim with little or no risk. Almost any article of clothing or material may be used, provided it is dry and of moderate thickness. Doctor Morton points out that death from electrical shock is only apparent death at first, and that there is practically always a time during which it is possible to resuscitate the victim by artificial respiration.

D.C. SUB-STATION DESIGN.

"NOTES on Direct-current Sub-station Design and the Plant Installed," was the subject of a paper read by Mr. H. D. Phelps before the Newcastle Students' Section of the Institution of Electrical Engineers. The author outlined the principal requirements of the site, buildings, etc., and discussed the lay-out of plant therein. He described the principal features of induction motor generators, motor converters, rotary converters and synchronous motor generators, and discussed their relative merits for sub-station equipment. Induction motor generators, on account of their low efficiency and poor power factor, especially at light loads, might be left out of consideration, as also might synchronous motor generators, on account of their high cost. In comparing motor converters and rotary converters, he gave preference to the latter for 25-cycle traction sub-stations, but for higher frequencies he considered the motor converter more suitable and less liable to flash over.

Mr. F. Ross Newman, resident manager in Toronto for the Canadian Fairbank Morse Co., Ltd., has gone to Europe for a well earned rest.

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THE C.A.S.E. AND GRADED CERTIFICATES.

WE note that a deputation of executive members of the Canadian Society of Stationary Engineers waited on the Minister of Agriculture again, recently, to press their desire for legislation on the subject of graded certificates for operative engineers in the Province of Ontario. A year has almost elapsed since a like proceeding took place, and if we may judge by the consideration given the request then and now, another year will in all probability elapse, in which nothing will be done in the direction indicated, and so on. The C.A.S.E. keeps its light too much "under a bushel" to make much headway, the executive and the various lodge officials being either too much involved in their own personal affairs, like most of us, or not being enough awake to the far-reaching advantages of even a moderate degree of publicity.

TORONTO WATER SUPPLY.

WILL the present administration, responsible to the citizens of Toronto, bring to a successful issue the questions of a satisfactory water supply and its filtration? That the outlook in this direction is not very favorable, must be freely admitted.

Changes in the personnel of the staff of any business or undertaking become necessary from time to time, and may be brought about by a variety of reasons. The whim of some individual occupying a relatively higher position may occasion the removal of a good man from office either by order or choice, but such a predicament is of insignificant import when compared to the combined yet distinctly diversified whims of say 30 men, in whose hands a popular vote places a little authority. Many people, probably a large majority of us, are entitled to more or less sympathetic treatment—to something more at any rate than we get, but without allowing the general feature to occupy a too prominent place in these remarks, let us say, that concerning men who have to earn an honest living, those unfortunate enough to be Government or municipal servants are well in the front rank for sympathy. Lives of City and Town Engineers, Industrial Commissioners, etc., all remind us—not as Longfellow puts it—that they cannot make their lives sublime.

The corporation and controllers of Toronto are plainly panic striken over the water situation, as evidenced by the proposition to invoke the aid of Lord Strathcona. Just think of it! A body of supposedly able-bodied and brainy men, charged with the government of the Queen City of Canada, so paralyzed and destitute of the virtue of manhood that the C.Q.D. call should even have been mooted concerning the Grand Old Man of Canada. Yes, and they are still busy blundering and groping along, and all the while unloading shekels as they go. The cost of administration of the department to which the water question belongs can hardly be said to have decreased since the official position of City Engineer was discarded for that of Works Commissioner, for in spite of the oft-repeated assertions that wonderful results would accrue from the new regime, it seems to us that staff auxiliaries and expert report costs lead to other conclusions. The corporation jaunt to Montreal to see the filtration plant installed there must necessarily have been of an edifying nature, enabling perhaps a few, or many of the members the opportunity of introducing themselves to the presence and purpose of such an installation.

We heartily sympathize with Messrs. Chipman, Sing and Randolph in their having to appear before the Toronto Corporation judgment seat to give account of their reasons for submitting the Scarboro water scheme, and we have to congratulate them on the backbone shown on the trying, although, after all, humorous occasion.

What Toronto needs is an engineer, who will be known as the City Engineer, a man who is alike able to administer, discern and determine, and whose judgment will put projects into effect and produce results. Engineers capable of producing results are no scarce commodity in this Dominion, neither do they need to be bolstered up with such mush as appears periodically in some sections of the daily press, concerning their being "the men who do things." Further, and pertaining to the City Engineer, he will fulfill his duties all the more admirably, the less he heeds the uncontrolled effusions of his miscellaneously composed, yet, strange to say, popularly elected civic authority.

THE READERS' POINT OF VIEW

Devoted to brief descriptive article contributions covering ideas and experiences pertaining to power plant practice and operation. We pay for accepted material.

HIGH SPEED TRANSMISSION DYNAMOMETER.

By James A. Adie.*

IT is often of great importance to ascertain the amount of energy produced by some form of prime mover, or absorbed in the operation of any apparatus. Various kinds of dynamometers have been devised for this purpose, the best known being the Prony brake. This brake, while possessing all the advantages of cheapness and accuracy, is only suited to the measurement of small powers, due to the heating and burning of the blocks, to the difficulty of lubrication, and to the liability of the wood to seize on the pulley. It can, moreover, only be used to measure the output of prime movers, while it is often necessary to discover the input of a driven machine.

Torsion Dynamometer.

Another form which has come into extensive use is the torsion dynamometer, used to ascertain the power of turbines on the great Atlantic liners. For this purpose a long sleeve is placed on the tail shaft, attached to it at one end only. At the other end is a multiplying device, whereby the motion of the shaft relative to the sleeve is shown in exaggerated form on a card. The horsepower is computed from the torsion of the shaft in the length of the sleeve, in accordance with tests previously made on test shafts of similar material. This dynamometer, while simple and accurate, only gives the maximum horsepower developed during the trial.

Obtaining Instantaneous Readings.

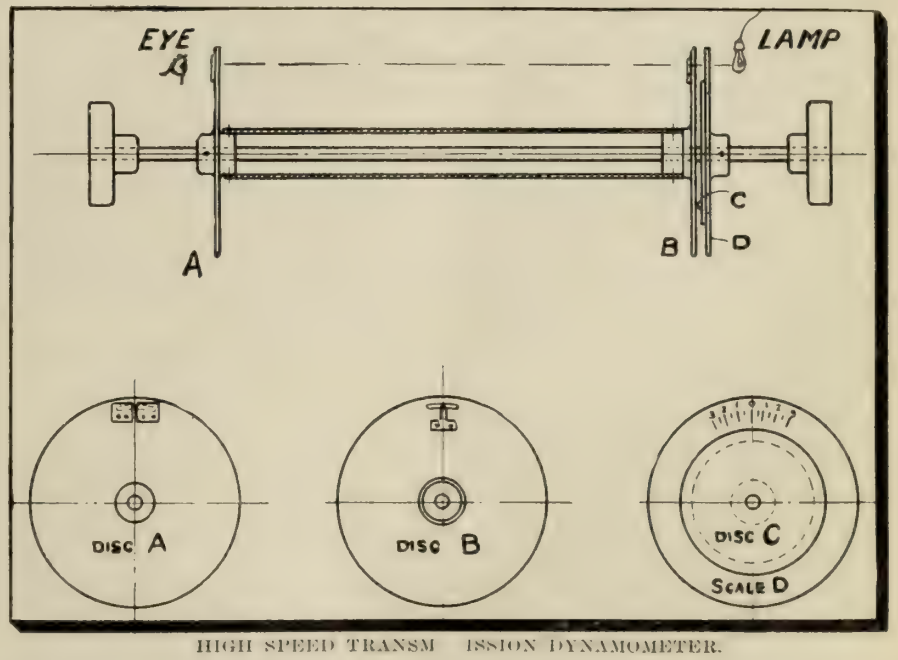
It is often desirable to know the power at a given instant, so that it may be compared with the instantaneous readings of other instruments, as in the case of tests on motors and generators, centrifugal pumps, blowers, or other high-speed rotary machinery. For instance, in the test of a generator it may be desired to know the energy taken to drive it under various loads and speeds, so that by comparing these readings with those taken from the switch board instruments a curve of efficiency may be drawn.

For this purpose a transmission dynamometer of the form shown in the sketch has been used, by which the horse-power at any particular moment may be ascertained. It consists of a shaft about 6 feet long, to which an ordinary flanged coupling is keyed at each end. One of these couplings is bolted to the coupling on the driven machine, and the other to that on the prime mover or other source of power.

The disc (A) is of cast iron, and is pinned through the hub to the shaft by a light pin, in order not to impair the stiffness of the shaft. Near the circumference a slot is cut through the disc and covered by two thin steel plates, so fastened by machine screws that the aperture may be regulated as desired. Usually the slit is set from 1-16in. to ⅛in. wide. To the hub on the back of this disc is attached a tube of wrought iron pipe about 4 feet long. This tube is pinned at the other end to the hub of disc (B), which is of the same diameter as (A). In disc (B) is cut a slot about 4 inches long at the same distance from the centre as that in disc (A). Disc (B) is bored to a running fit on the shaft. A small brass pointer is fastened over the slot by screws, so as to be adjustable sideways for purposes of calibration.

Behind (B) a smaller disc (C) is pinned to the shaft, and attached to its periphery is an annular piece of transparent celluloid, marked off in equal divisions, about ⅜in. apart, each with a corresponding number, as shown. These numbers and marks are stamped in and blackened to render them clearly visible.

The pointer on (B) is set opposite the zero mark on the scale behind it, and the slit in (A) is placed in line with



HIGH SPEED TRANSM ISSION DYNAMOMETER.

both. Now it is evident that if one coupling be held fast and a turning force be applied to the other, the disc (B) will follow the motion of disc (A), while disc (C) will remain stationary, and the motion of disc (B) relative to (C) will be through the same angle as the torsion of the shaft between (A) and (C).

How the Dynamometer is Calibrated.

This appliance must be calibrated before using. For this purpose it is set

*With the Canadian Boving Co., Limited, Toronto

up and a lever is bolted to one coupling and counter-weighted, so as to cause no turning moment by its own weight. Weights are applied at the end of the arm sufficient to rotate disc (B) relative to disc (C), causing the brass pointer to move to new positions opposite the divisions on the scale (D). The loads corresponding to the various divisions are then noted.

In one test a shaft 1 1-16-inch in diameter 48 inches long twisted through an angle of 9 degrees with a load of 186 lbs. at 30 inches radius. This corresponds very closely to the result of the formula:

$$a = \frac{Prl \times 583.6}{d^4 E}$$

where a=angle of torsion in degrees.
P=force in lbs. applied at end of lever arm.
r=length of arm in inches.
l=length of shaft in inches.
d=diameter of shaft in inches.
E=co-efficient of elasticity (about 12,000,000 for steel).

Application of the Dynamometer.

In operation the dynamometer is placed in the line between driver and driven so that it transmits the full power to be measured. The torsion causes the pointer on (B) to move from opposite the zero mark on the disc (D) to a new figure, depending on the power. A lamp is held behind the scale on (D) and on applying the eye opposite the slit in (A) and sighting past the pointer, the number indicated on (D) may be read as if it were standing still; for the slit (A) flashes past the eye so rapidly and the intervals between the impressions on the retina are so short that it causes the illusion of a stationary figure.

This dynamometer cannot be used successfully below 600 R.P.M., as a lower speed would not produce a clear image on the eye. It may be used for rotation in either direction.

The figure opposite the pointer having been read, it is known from the previous experiments that this represents a certain force in pounds at the end of the lever used in the experimental test. The speed may be ascertained by a revolution counter or the more modern direct reading tachometer of Dr. Horn's type.

This force exerted through the circumference of the circle described by the lever arm and multiplied by the number of R.P.M. gives the power in foot-lbs. per minute, which, divided by 33,000, is the horse-power transmitted. In other words:

$$HP = \frac{Pr \times 2 \times 3.1416 \times N}{12 \times 33000} = \frac{Pr \times N}{63025}$$

where P=force in lbs. at end of lever arm.
r=length of lever in inches.
N=R.P.M.

In designing such a dynamometer care must be taken to select a size of shaft in which the stress will not exceed the elastic limit of the material. At the same time the angle of torsion should be as large as possible in order to give a good range on the scale. The elastic limit for steel, according to the manufacturers' specifications, should be not less than half the ultimate strength, and may be taken at 40,000 lbs. per square inch.

Examples Worked Out.

Supposing that a generator of 100 k.w., running at 1,500 R.P.M., is to be tested:—100 k.w. is equal to about 134 h.-p., and the twisting moment (Pr) on the shaft is:

$$PR = \frac{63025 \times HP}{N} = \frac{63025 \times 134}{1500} = 5630 \text{ inch lbs.}$$

By the commonly accepted formula for shafting

$$d = \text{cube root of} \frac{16PR}{3.1416 \times S}$$

where Pr=twisting moment on shaft in inch lbs.
S=permissible fibre stress on shaft in lbs. per sq. inch.
d=diameter of shaft in inches.

It would not do to stress the shaft right up to its elastic limit, so we will allow a factor of safety of 2, which will give 20,000 lbs. as the value of S in the above formula.

In the example under consideration

$$d = \text{cube root of} \frac{16 \times 5630}{3.1416 \times 20000} = 1\tfrac{1}{8} \text{ inch}$$

Since the fibre stress has been kept low a dynamometer having a shaft of this size could be used for testing generators of larger size than the example given; but care must be taken that the elastic limit is never exceeded. The diameter of the discs should be such that the rim speed will not exceed 8,000 feet per minute.

The angle of torsion of such a shaft, 48 inches long, between discs (A) and (C) may be found from the formula given above, viz.:—

$$\text{angle} = \frac{Prl \times 583.6}{d^4 E}$$

$$\frac{5630 \times 48 \times 583.6}{(1\tfrac{1}{8})^4 \times 12{,}000{,}000} = \text{ab. } 8 \text{ degs.}$$

OPERATION OF THE INTERNAL COMBUSTION ENGINE BY THE NOVICE.

By T. F. McKee.

A REMARK we often hear made about the gas engine is: "It is so simple that anyone can learn to run it in a few hours." But let us consider that there are two ways of running it, also two kinds of operators, the expert or man who spent months or perhaps years in studying the design and principles of operation of this type of engine, and who delights in always keping his engine running up to its highest efficiency, and the novice or man, who learned all about gas engines in a few hours, and who generally runs his engine on a system which we might term "hit or miss," principally "miss." As long as the flywheels are going round he thinks his engine is running just as well as that of his learned opponent.

Men who own gas engines of the larger size, where it is necessary to employ operators, and who also believe that all is O.K. so long as the engine is running, are likely to employ men of the second-class mentioned, and to their regret soon find that their outfits come far short of their expectations, and are nothing to them but a source of expense. For to successfully operate a gas engine and get the highest mechanical efficiency out of it, it is necessary that it should have just as much care and attention as the best steam engine.

I have frequently been in conversation with operators of gas engines, and have been very much surprised to find how many men there are, who, when questioned a little in regard to the operation of their engines, know that it is gas or gasoline that runs their engines, but do not really know how it runs them, or the principle of operation.

The following imaginary scene bears a very close resemblance to conversations which I have actually heard from time to time:

What Jim Thought He Knew!

Dick Murray had just returned from the city where he had been attending the Technical School, and was sitting on the verandah one evening, when he noticed his old chum, Jim Martin, coming up the street.

"Hello! Jim," cried Dick, "How are you getting along?"

"Oh, fine," replied Jim, "I have just been out to-day fixing up Mr. Smith's gasoline engine."

"Oh; is that so? What type of engine was it, Jim?"

"Why, it was a two-cylinder two-cycle engine; but there wasn't much wrong with it. I cleaned up the valves a little, timed up the ignition, and put in a new set of batteries, and she ran as good as ever."

"What system of ignition was it, Jim?"

"It was what they call the "Jump Spark System." It had two igniters, one for each cylinder, operated from the cam shaft, which runs one-half the speed of the engine shaft."

"You have been around gasoline engines quite a lot have you not, Jim?"

"Oh, yes," replied Jim, "I have been running different makes of them for the past two years, and I can do nearly anything with them now."

"Well, you should know a little about them by this time," replied Dick, "at least I should think you would learn quite a little in two years. Say! Jim, you said that it was a two-cycle engine you were fixing to-day. Well, what do you mean by two-cycle?"

"Why!" replied Jim, "a two-cycle engine is one with two cylinders and a four-cycle engine has four cylinders, and so on."

"Oh, I see," said Dick, "that is how it goes is it?"

"Yes, that is the way. You see, Dick, every time the flywheel goes around the engine takes in charge and exhausts it."

"Have you had any experience with four-cycle engines, Jim?" asked Dick.

"No, not very much," replied Jim, "there are very few four-cylinder engines around here. I know of a few up at the lake in boats, but have never had anything to do with them, but they would be just as easy to operate as a one or two-cylinder engine."

Dick Puts Jim Right.

By this time Dick was feeling rather amused at the erroneous statements made by Jim, and was just thinking that he would try and change the subject of conversation, when Jim asked:

"What kind of work have you been taking up at the schools, Dick?"

"Why," replied Dick, "I have just completed their course on "Gas Engines," including stationary, automobile and marine work, and have now a good knowledge regarding the principles of operation of the different types of engines."

"Oh, is that so?" replied Jim in a tone of astonishment, for he did not think that his chum was now a graduate on "Gas Engineering."

"Well, I am glad to hear that," continued Jim, "and perhaps you won" mind telling me something you learned from the professor down there."

"Why, not at all, Jim. I don't reckon I know it all, but I think I can perhaps give you a few points which may be very useful to you; for I am rather inclined to think by the statements you have just made that a course from the schools would be very beneficial to you. You said, Jim, that the engine you were fixing to-day was a two-cylinder two-cycle didn't you?"

"Yes, I did."

"Well, you also spoke about cleaning the valves and timing up the igniters on a two-cycle engine with jump spark ignition! Is not that what you said, Jim?"

"Yes, it is."

"Well, Jim, I will now endeavor to show you where you are wrong in your statements. Take for instance the meaning of two and four-cycle engines. The word 'cycle' means a series of events completed. For instance, from Monday of this week until Monday of next week is a cycle, or a series of events necessary to complete the week or cycle, and the word cycle does not refer only to gas engines, but may be applied to many things.

"Properly speaking the operation of a gas engine should not be termed as being two-cycle or four-cycle, but as a two-stroke cycle or a four-stroke cycle; for in a two-stroke cycle engine the cycle is completed by two strokes of the piston, and in a four-stroke cycle engine the cycle is completed by four strokes of the piston; namely, suction, compression, working and exhaust.

"You see, Jim, a two-stroke cycle engine has no valves, but has ports or openings in cylinder walls, which are opened and closed by the moving piston. The exhaust and inlet ports are on one side of the cylinder, situated about half way down, the exhaust port being just above the inlet port and on the opposite side, is a port leading from the by-pass, which is a channel leading from the crank-case of engine. When the piston has nearly reached the top centre of the up-stroke, the bottom edge of it uncovers the inlet port, thus drawing into the crank-case a charge of gasoline and air; and as the piston comes down again this port is closed compressing the charge in the crank-case at a pressure of a few pounds per square inch, until the piston reaches the centre of the down stroke, when the by-pass and exhaust ports are opened at the top of piston, allowing the burnt gases to go out and the fresh mixture to rush from crank case into cylinder on top of piston. The fresh charge is compressed and ignited as the piston again reaches the top of its stroke, thus completing the cycle in two strokes of the piston.

"So you see, Jim, the two-stroke cycle engine is very different from the four-stroke cycle and is mostly used in motor boats, where high power and light weight are very essential.

"As you are more or less familiar with the working of the four-stroke cycle engine, it being the type you have always worked on, I will not enter into any details on it, but will give you a few hints on electric ignition. The two systems of ignition generally used are called the "Jump Spark" and "Make and Break" systems. In these the current is generated by means of a set of batteries and spark coil, or by a magneto or dynamo, the latter being practically small generators driven from the engine. The engine as started from batteries and switched over to magneto when the engine gets up to speed.

"Well now, Jim, consider the "Jump Spark" system. There are no igniters at all as you thought, but only what are called spark plugs, which are small electric fixtures, one being screwed into the head of each cylinder and through which a current of high voltage passes, which ignites the charge. This system works as follows:—

"Connected to the crankshaft and driven at one half the speed for a four-stroke cycle, or at the same speed for a two-stroke cycle, is a small shaft, called the timer shaft, fitted with a cam, which revolves inside a cylindrical arrangement called the timer. The latter has insulated terminals fitted to it, with which the cam comes in contact while revolving, making and breaking the circuit in the proper time and rotation. The spark plug is somewhat different from the igniter in that it has two fixed electrodes, one insulated and one grounded, instead of one fixed and one movable electrode as in the igniter. These electrodes are set about 1-16-inch apart at the points, and instead of the spark being made by the making and breaking of the points as in the igniter, a current of high voltage passes down the insulated terminal and jumps across the gap to the point of the other terminal, which is grounded to the engine and batteries, the circuit being closed and broken by the cam coming in contact with the insulated terminals of the timer.

"The coil used for this system is called a "Jump Spark" coil and has two windings, one a primary or low-voltage and the other a secondary or high-voltage winding through which the current while passing is greatly increased. This is necessary in order to cause it to jump across the gap between the plug points under high compression.

"I will not endeavor to explain to you the source of current through the jump spark system, as you would not understand it very clearly unless I had the equipment here to demonstrate it to you. So you see, Jim, this system is one you have never yet seen, and the one you are familiar with is the "Make and Break" system, where igniters are used with a primary spark coil using a current of low voltage."

By this time Jim was feeling rather embarrassed by the unexpected remarks he was hearing from Dick as compared with the very green remarks made by himself just previously, and was thinking that he himself had a little to learn yet before he knew all about gas engines.

PROGRESS IN NEW EQUIPMENT

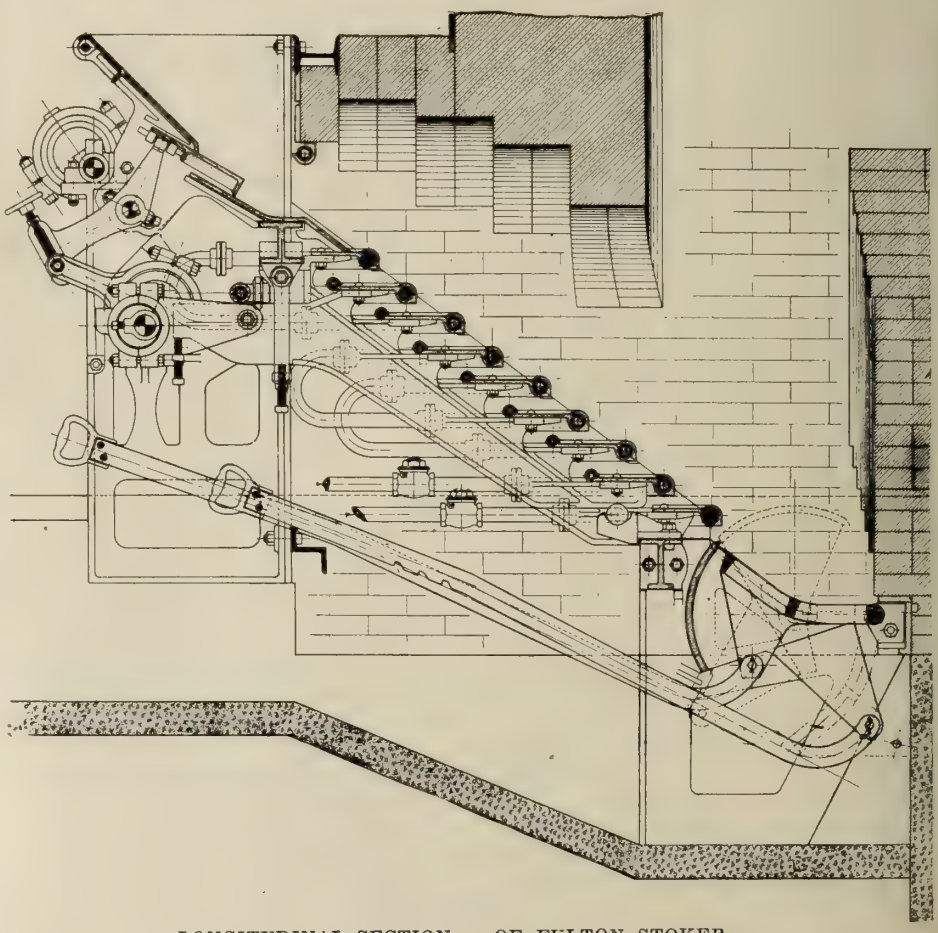
There is here provided in compact form a monthly compendium of the power plant manufacturers' achievements.

THE FULTON WATER-COOLED MECHANICAL STOKER.

A NEW stoker has been placed on the Canadian market by the Hare Engineering Co., Ltd., 14 King Street East, Toronto, which is designed on decidedly original lines. While this mechanism, which is known as the Fulton Water-cooled Mechanical Stoker, is new to Canada, it has had a long and successful experience in the United States, and is in use in some of the most prominent plants in that country. It has taken a good many years for the merits of mechanical stoking to be generally recognized by plant owners, even when it is so easy to ascertain the facts in relation to any subject, by consulting engineers, architects and others who have the design of power plants under their care. This is not because stokers have not been able to demonstrate their great superiority over hand firing methods so popular with the uninitiated, but because of the many defects in design which characterized the earlier machines and which resulted in an altogether too high rate of depreciation and repairs, thus lessening to a large extent the saving at first effected. There is absolutely no reason whatever why a mechanical stoker should have a higher rate of depreciation than other machines, such as pumps, condensers, economizers, etc., found in power plants. Although it is often stated that heavy repairs are to be expected with such machines, this view cannot be accepted today in the light of modern improvements.

The Fulton Water-cooled Mechanical Stoker, which has been developed within the last five years, is of the natural draft type. If an engineer had been asked a few years ago if it were possible to carry 100 per cent. overload with a draft pressure of .18 inches water gauge, he would naturally have said that it was not, and that in order to carry such overloads, forced draft must be employed. He would have been quite right then, although decidedly wrong to-day. The development of the Fulton Water-cooled Stoker has not only made it easily possible to carry such heavy overloads with medium and light draft pressures, thereby securing all the flexibility of a forced draft stoker without the expense of operating the auxiliaries, but by a most radical departure from all other previous designs, a system of water-cooling of the parts has been developed which has solved completely the problem of stoker repairs, and has reduced the rate of depreciation to a point hitherto considered impossible. Records of this stoker covering some four years of continuous operation show most remarkable results with regard to economy, capacity and low repairs.

In a large plant in Cleveland one of these stokers, installed under a 466 h.p. Stirling water-tube boiler, was operated twenty-four hours per day, seven days per week, for over two months, carrying continuously an overload of 100 per cent., or generating 935 horsepower when burning low-grade slack coal, averaging 12,000 B.t.u. per pound with 3.7 per cent. sulphur. The draft at the grate during this severe trial did not average more than .2 inches water gauge. The Fulton stoker showed an evaporation efficiency in the neighborhood of 70 per cent., notwithstanding the overloads carried.



LONGITUDINAL SECTION OF FULTON STOKER.

Stoker Detail.

The Hopper, as will be seen, extends entirely across the front of the stoker, thus providing a large coal capacity.

The back is continuous and provides a stiffner for the hopper independent of the boiler front. The lower side of this back plate is water-cooled, which feature is a distinct advantage in not only absolutely preventing the plate from burning out, even after many years continuous use, but, and of no less importance, it keeps the fire from creeping up into the hopper while banked and eliminating trouble from the coal in the

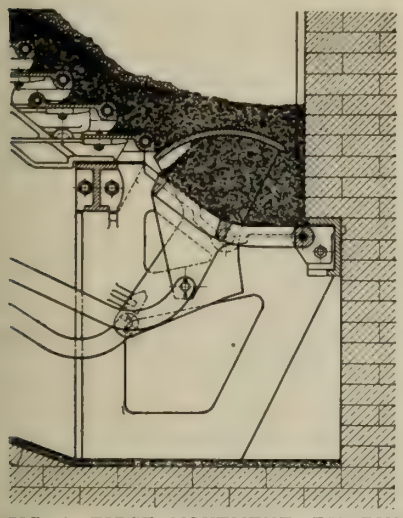


FIG. 1. FIRST MOVEMENT, DUMPING SHIELD PULLED UP.

hopper fusing into coke masses and interfering with the free action of the coal feeding mechanism. On starting up the stoker when there is no steam in the boiler to operate the driving engine, the feed slides are always easily operated by hand. These points will be appreciated by engineers generally.

The Coal Feeding Mechanism.

In the bottom of the coal hopper are the coal feeding pushers. These slides

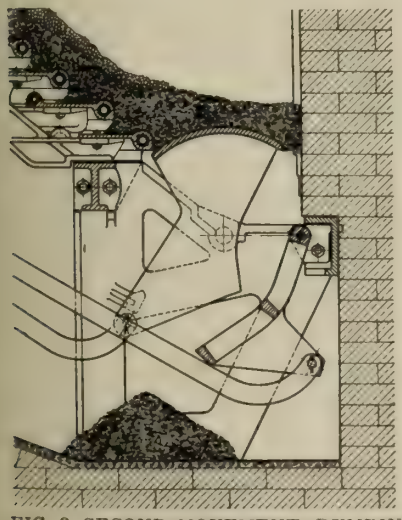


FIG. 2. SECOND MOVEMENT, DUMPING GRATE DROPPED.

are so designed that by a simple reciprocating motion the coal is fed from the hopper and pushed over the dead plate to the top grate bar to begin its movement down the grate incline. The actuating mechanism of these slides is extremely simple in detail, and readily adjustable both as to the extent of the movement backward and forward, and also as to the number of movements per minute. All adjustments can be made while the stoker is in operation, yet, once the stoker has been adjusted to suit the extent of the normal load and the character of the fuel to be burned, little attention, it is claimed, becomes necessary.

A feature of the feeding mechanism that is of considerable importance is the employment of a short pusher at each side of the stoker, capable of independent adjustment from that in the centre. By the adoption of this arrangement it is easily possible to feed the coal at the sides, next the brick side walls somewhat heavier than in the centre, and thus prevent the formation of holes in the fire along the sides, owing to the more active combustion that takes place there due to the radiation from the side walls, and the lower position of the ignition arch.

The Grate System.

The grate surface of this stoker is on an incline of about 35 degs. with the horizontal and is formed of a number of broad flat horizontal plates arranged in an overlapping series of steps, one above the other, from the dead plate which receives the coal from the hopper, to the dump grate at the bottom. These flat grates are all identical in design, but are arranged in two separate banks, moving and fixed, and alternating the one with the other over the entire grate surface. The fixed grates are bolted to the side risers or side frames of the stoker while the moving grates are bolted to moving risers which at their upper ends are connected to the eccentrics on the stoker shaft. Their lower ends are carried on rollers on the frame. This method makes it possible to secure a movement of the bank of moving grates, which, at its upper end is elliptical and at its lower end, approximately a straight line. The number of revolutions of these eccentrics is entirely under the instant control of the fireman, hence while the extent of the horizontal movement is fixed, the rate of feed of the coal along the grates is controlled by varying the speed of the eccentric shaft. While the vertical movement of the eccentric is itself fixed, the similar movement of the grates is modified to suit the different grades of fuel to be burned, and by a very ingenious device, this vertical movement can be varied from nothing to the full movement of the eccentrics. Thus, for a grade of coal of high coking values, the grates may be adjusted to move in an ellipitical or a straight line movement forward, and an elliptical movement backward, carrying the moving grates at all times clear of any loose coal or coke which may lie on the rear of the fixed grate below. The action of the grates as described is such as to compel the coal to move forward by a controlled and definite movement, and to any degree of lifting action deemed necessary thus controlling completely

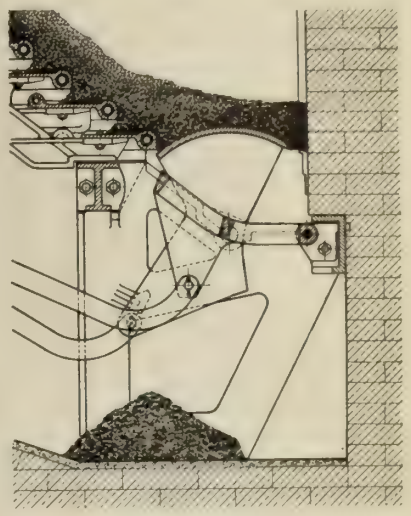


FIG. 3. THIRD MOVEMENT, DUMPING GRATE RAISED.

not only the action of the burning fuel in the fire but the ash as well from the hopper to the dump grate.

Another advantageous effect gained by this grate movement is the lifting and breaking up of any coke masses that may form in the fire, thus securing the freest possible passage of air through the fire and facilitating rapid combustion. As the coke and accumulating ash are forced towards the dump grate, the lifting action of the grates becomes less

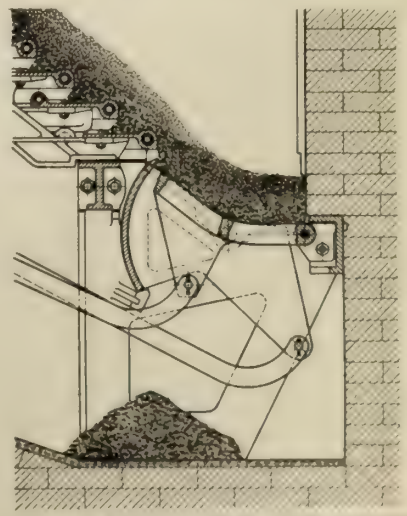


FIG. 4. FOURTH MOVEMENT, SHIELD DROPPED, FIRE CLEANED.

and less until it disappears entirely, thereby preventing the formation of air holes in the fire.

By reason of the considerable overlap that exists between each grate and its neighbor, the sifting of fine unburned coal through to the ash pit is absolutely prevented, while the action of the moving grates is such as will push back into the fire any lumps of coal or coke that may work in between the grates. It should be noticed also that this grate movement is secured without alteration in the total extent of air space between the grates.

Positive vs. Gravity Feeding.

A consideration of the details of the feeding mechanism of this stoker will show the advantage of the positive feed as compared with the gravity feed. In stokers employing the gravity system of feeding, the angle of inclination of the grates to the horizontal must be considerable, and in order that the coal be made to move down the incline freely, this angle must be made greater than the angle of rest of slack coal.

The Water-Cooling System.

The one feature by which, this stoker differs materially from others is the water cooling of the grate bars. Each grate bar is water-cooled along the side in contact with the fire, by casting into it a 1¼ inch extra strong cold drawn seamless steel tube. This tube is first properly shaped and placed in the mold and the grate bar cast around it. The tubing used in these grates is specially made for this purpose, and is tested to 1,000 lbs. per square inch air pressure under water. The connections between one grate and the next are made through return bends of the same tubing and all connections are made with special bronze-to-bronze 4-bolt flanged Dart unions, making leaks practically impossible.

Treating the fixed grates as one unit and the moving grates as another, water connection is made direct from the boiler to the lowest grate in each bank and from thence upward from grate to grate until the top is reached, where another connection is made to the boiler above the water line. No flexible joints or hose connections are used in the entire design, and therefore no leaks are possible. The flexibility necessary to permit the action of the moving grates is secured by a free length of the same seamless tubing at the inlet and outlet of the grates, so that the small movement necessary in the grates is provided by the flexibility of the tubing itself.

The circulation of the water through the grates does not depend on the unbalanced condition caused by an increased temperature at one part of the cycle as is the method adopted in almost all steam boilers, for, if this were the case, the tubing in the grates would soon clog up with scale, preventing the flow of the water and rendering the water cooling system useless. This difficulty has been got over by the invention of the flash system which is claimed to be unique with this stoker. Inserted in the individual inlet pipes to the fixed and moving grates are two 1¼ inch bronze swing check valves, arranged to open and allow water to pass to the stoker, but to close against any flow in the opposite direction. On the application of heat to the grate bars, the water in the tubes is partly evaporated into steam. The mixture of water and steam thus formed being prevented from discharging downward owing to the action of the check valves, is driven upward through the stoker piping, and into the boiler. As soon as this discharge takes place, the check valves open and permit more water to enter the stoker pipes from the boiler, when the same violent action is repeated. In normal service, this flashing takes place every 10 or 12 seconds, and is accompanied by sufficient velocity to scour and polish the inside surface of the tubes and thus most effectively prevent scale accumulation. Grate bars cut in two after being in continuous use for four years show an absence of scale.

The Dump Grates.

As will be seen by the accompanying cuts, the ash cleaning device of the Fulton Stoker is extremely simple. It is claimed by this arrangement to separate the ash and clinker from the burning fuel without the usual loss of unburned coke or live coal, while at the same time, preventing the entrance of cold air during the operation of cleaning. The dumping arrangement is not automatic in the sense usually employed, that is to say, it does not grind out clinker ashes or coke as the case may be at all times whether the fire requires cleaning or not, but is so designed that perfect cleaning can be secured when the condition of the fire warrants it, and under conditions that promote the highest possible economy.

It will be noticed that the dump gear consists of two parts, the shield and the dump grate. In the operation of cleaning, the shield is thrown up as in Fig. 1. This cuts into the fire at the point where the ash and clinker accumulate, thus not only preventing the burning fuel from being discharged into the ash pit but by extending across the dump grate to the face of the bridge wall, effectually sealing the ash dump from the entry of cold air while cleaning. The dump grate is next dropped, Fig. 2, carrying with it the ashes and clinker held under the dump shield. It is then returned to normal position, as in Fig. 3. By lowering the shield again, as in Fig. 4, the burning fuel is allowed to flow over the dump grate. In this way, perfect cleaning is secured by a very simple and effective arrangement.

In the many tests that have been made of this stoker the percentage of good coke present in the ash is extremely low and compares very closely to the chemical analysis.

Repairs.

The economy of the Fulton Stoker is shown, perhaps, to better advantage from a consideration of repairs point of view than from any other aspect.

In a plant at Reading, Pa., 1,000 H.P. of these stokers have been in continual service 16 hours per day for four years, and carrying a large overload. The total repair cost during this time was at the rate of 2.4 cents per horse power per year.

A NEW BOILER SCALE REMOVER.

AN interesting method of removing scale from boilers has just been introduced to the Canadian market by the Dominion Specialties, Ltd., 44 Adelaide Street West, Toronto. The method consists in introducing into the boiler a heavy viscous fluid called Perolin. This preparation is of German origin and has long been favorably known all over Europe, where factories for its manufacture exist in nearly every country. Three years ago its manufacture was also commenced in the United States, where Perolin is said to have been wonderfully successful and widely adopted.

Strictly speaking, Perolin is not a boiler compound, since its action is entirely different to that of the usual chemical compounds. Its peculiar properties are that it does not dissolve the scale or scale-forming sediment, but, having a strong affinity for the heated metal of the boiler, separates the scale from the metal, mechanically leaving a preservative film on the water covered surface. The scale adhering to the metal is a non-conductor of heat, and being of a stony formation and non-elastic, will neither expand nor contract, and, therefore, when the metal expands, this coat of scale becomes filled with cracks extending through to the metal.

When an amount of Perolin proportionate to the heating area is injected into the boiler water, its affinity for the heated metal causes it to be drawn through the cracks in the scale into contact with the metal, where it works its way along the steel, breaking the bond of adhesion between the scale and the metal, so that the scale falls off and can be easily washed out. The preservative film thus left on the metal

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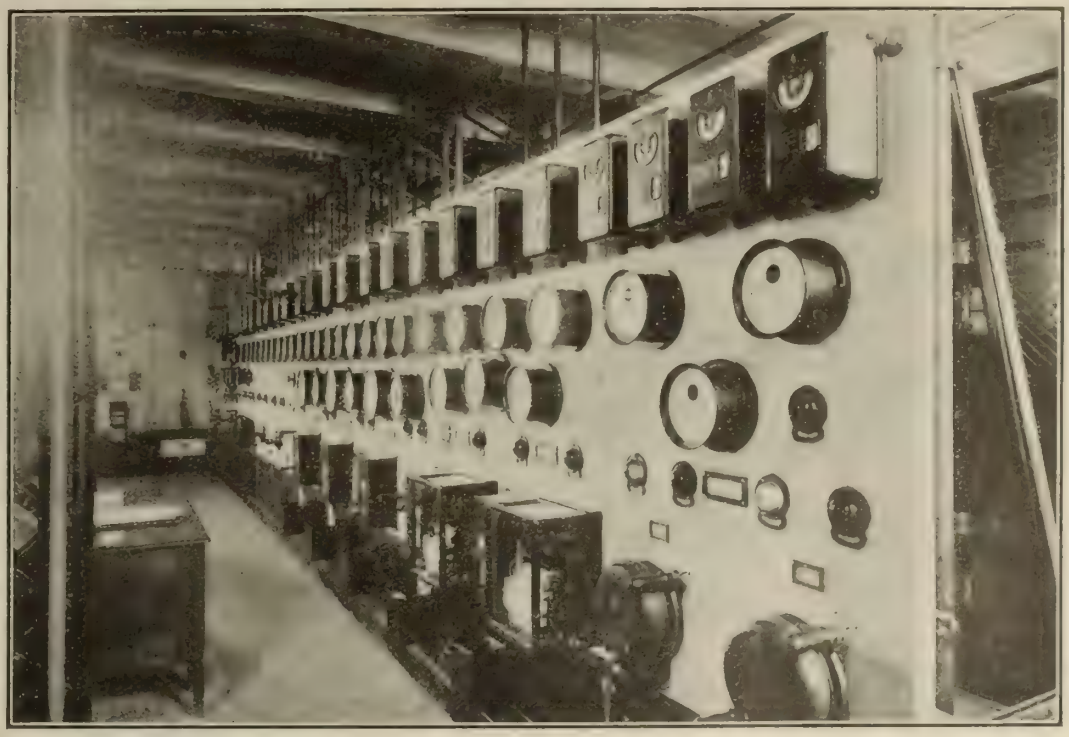

SIEMENS 18 PANEL 22000|2200|600 VOLT SWITCHBOA RD SUPPLIED AND INSTALLED BY US FOR THE CITY OF PORT ARTHUR.

We supplied the complete sub-station equipment, consisting of 7 750 K.V.A., 22,000 volt transformers, switchboard shown above, lightning arresters, and 2 750 H.P. motor generators.

Half the foregoing was a repeat order after our apparatus had been in satisfactory operation for 18 months.

We undertake the complete equipment of electrical plants of every description up to and including 110,000 volts.

Siemens Company of Canada, Limited

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prevents the precipitated scale-forming sediments of the water from adhering thereto, keeping them in suspension until removed through the blow-off pipe when blowing off the boiler. On account of the compound having a higher conductivity of heat than water, this surface does not in any way hinder the transmission of heat.

The company have such faith in their product that they are offering to ship to any boiler plant sufficient of the preparation for a 60-days' test on the understanding, that if it does not accomplish what is claimed for it, no charge will be made. Perolin is claimed to have no detrimental effect on metal, tubes or packing so that steam from boilers treated with it can be used with perfect safety in breweries, ice plants, dye works, and for cooking, etc.

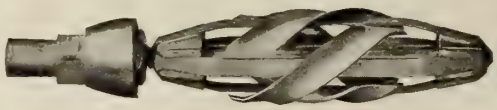
KIESELGUHR.

KIESELGUHR is infusorial earth formed from minute plants having a single cell and known as Diatoms. It offers very great resistance to the transmission of heat or cold, being equal or superior to magnesia in this respect at a greatly reduced cost. It is thus admirably adapted for use as an insulating material for ice houses, cold storage plants, refrigerators, boilers, steam pipes, dwelling houses, etc. Diatomaceous earth is practically pure silica and is absolutely indestructible, as any less degree of heat than 6,500 F. does not affect it. It has been used under the name of Kieselguhr in Germany and other European countries for a number of years, and about 18 months ago a United States Company was formed to handle it, and have, it is understood, met with great success. This company's mines are located at Lompoc, California, and are said to contain the largest and purest deposit yet discovered.

The Canadian market is being supplied by the Kieselguhr Company of Canada, Ltd., 520 Traders Bank Building, Toronto, of which Mr. Robt. Graham is manager.

COMMON SENSE FLUE CLEANER.

THE Garlock Packing Co., Ltd., of Hamilton, Ont., are handling a flue cleaner, which carries the name of "Common Sense." It was given this name because it never gets stuck in a flue, and will pass all welds or collapses. The common sense is in the design. The makers claim that the ordinary flue-cleaner fails to get the flue clean be-



"COMMON SENSE" FLUE CLEANER.

cause it only rubs the baked carbon, which cannot be rubbed off; also, that others run too hard ,due to the rub being almost square across the flue. This flue cleaner is adjustable to wear, the latter coming on the cutters or knives without injury to the frame. By passing a file over the knives the latter can be sharpened.

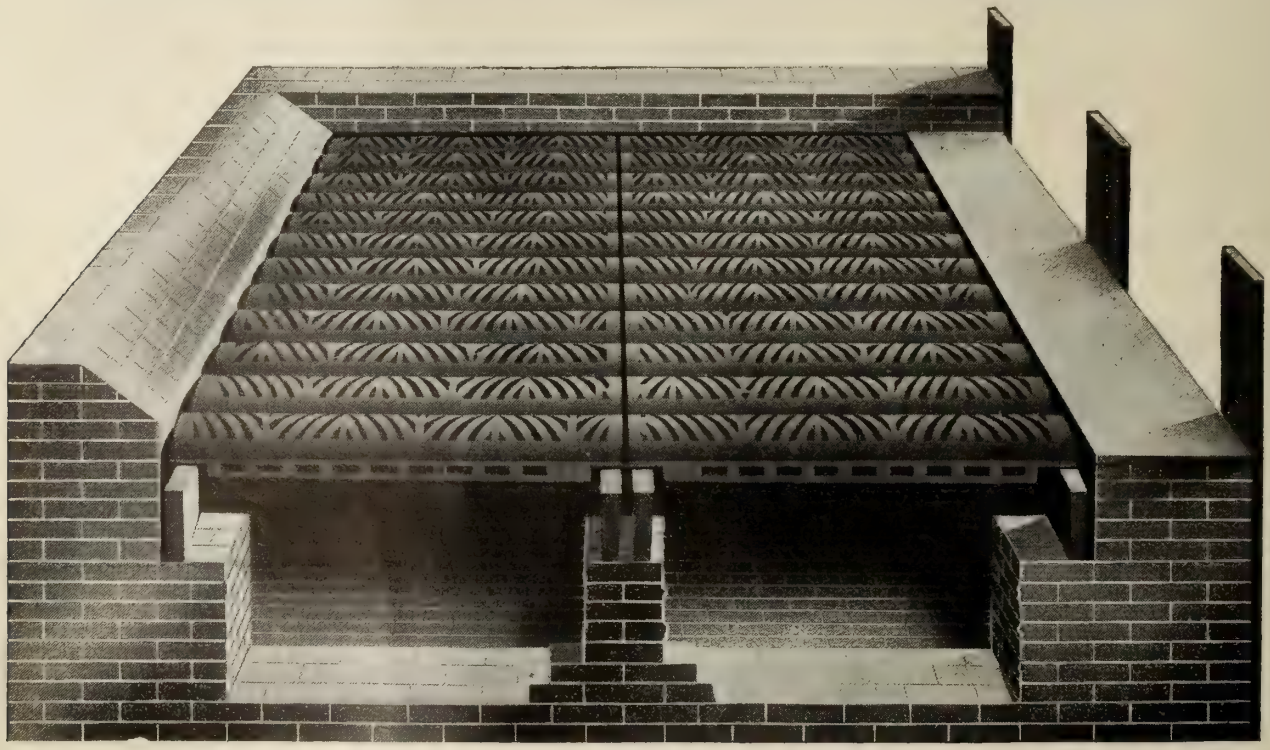
THOMAS GRATE BAR EQUIPMENT.

IN the August 1912 issue of The Power House an illustrated description of the Thomas Grate Bar was given. Since then a development has taken place relative to the grate bar setting equipment, and the present article is designed to draw attention to this new feature.

The illustration, of itself, displays effectively the means adopted to care for the bar setting which consists of a centre double plate bearer and single plate bearer at each side. It will be noted that the former is so constructed that an air supply up through the ends of the bars is always assured.

Among the many claims for increased efficiency and economy of operation of these grate bars and their setting equipment, may be cited those of preservation of fire, bridge and front walls, due to the provision made for expansion and contraction. Long life is also claimed for the bars themselves, and such features as saving of fuel, smoke reduction and less arduous work for the fireman are naturally to be expected from what has been already said. The Thomas Grate Bar Co., Birmingham, Ala., are the originators of this apparatus, and a short time ago they made arrangements for manufacturing in Canada so as to fill Canadian orders promptly and on a competitive basis.

T. F. Kelly, contract agent of the Cataract Power Company, has accepted a position at Dayton, Ohio.



THOMAS ELLIPTIC GRATE BARS AND FURNACE SETTING.

Cyclone for Air or Steam

How Much Does It Cost You To Clean Your Boilers?

The CHEAPEST tube cleaner for you to buy is NOT the one having the lowest selling price.

It's the cleaner that finally costs the least for Maintenance, Labor and Operation.

A well known manufacturing plant wanted the CHEAPEST CLEANER.

The Engineer used our Cyclone Cleaner and a type of Cleaner resembling the Cyclone to all outward appearances, but which sold for a much lower price.

It cost him EIGHTEEN CENTS PER TUBE to clean with the imitation cleaner—WHILE THE CYCLONE DID THE WORK AT ONE AND ONE HALF CENTS PER TUBE.

Result:—The saving effected by the Cyclone would buy him a dozen of the "cheap" cleaners, WHICH WAS THE CHEAPEST?

Don't start cleaning your boilers without a Liberty Cleaner.

ASK US ABOUT THEM.

Liberty Mfg. Co.

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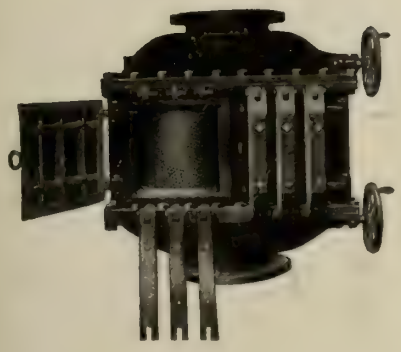

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Catch the Leaves

You can't keep the leaves from falling off the trees, nor you can't keep them out of the streams, rivers or lakes, but you **Can** keep them out of your power plant and still get a **continuous supply** of **clean water,** if you install a **Twin Strainer** in your water line.

Keeping fish, leaves, etc., out of your plant eliminates that constant cleaning of equipment. The **Twin** is made to clean easily and quickly. **Two Valves, two Baskets—continuous flow, uninterrupted service—all sizes for all pressures.**

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POWER PLANT DEVELOPMENTS

A record of current municipal, manufacturing and general industrial projects, involving steam, gas, oil, electricity, air and water power equipment requirements.

BRITISH COLUMBIA.

Port Alberni.—Messrs. Quinn & Rowley have been given the contract to install the lighting system in Port Alberni, the price being $10,000.

New Westminster.—Preparations are being made on Lulu Island, to build a new plant for the Heaps Engineering Works. Piles are being driven for the machine shop and other buildings.

Victoria.—Tenders were received up to noon of Saturday, February 15th, 1913, for the purchase of the engines and boilers with fittings at pumping stations No. 1 and No. 2, Matsqui. The plant at each station consists of one 16-in. by 36-in. Hamilton Corliss engine, one Babcock and Wilcox water tube boiler about 180 h.p., one duplex boiler feed pump, one separator, one jet condenser, etc. E. Wilmot, Inspector of Dykes, office of Inspector of Dykes, Victoria.

ALBERTA.

Macleod.—Natural gas is being tested under No. 1 boiler at the power house.

Macleod.—The first building permit this year was given to the Calgary Brewing Co., for a large cold storage warehouse on N. Fourteenth St. It will measure 34 x 34 feet, with a big basement, and a complete refrigerating plant.

SASKATCHEWAN.

Prince Albert.—This city will borrow $400,000 for use on the La Colle Falls development scheme.

Regina.—J. A. Menzies will erect a sawmill at Merritt in the spring. He will purchase a new boiler and engine, and some other machinery.

Regina.—According to a report on lignite compiled by R. O. Wynne-Roberts, this city can be supplied with power from the mines at $27 per h.p. per annum.

Saskatoon.—The Saskatoon Electric Railway have been asked by the town of Sutherland, about two miles from here, to extend its line there. Sutherland is also considering the installation of an electric light and power plant to be owned and operated by the municipality.

Prince Albert.—The Commissioners of this city were authorized to purchase two new 300 h.p. Babcock and Wilcox boilers and a new turbine exciter for the enlargement of the present power plant. Preliminary steps were taken towards the erection of a larger power house in another portion of the city.

MANITOBA.

Winnipeg.—A company here have made an offer to the Hercules Rotary Engine Co., Ltd., to manufacture their specialty.

Brandon.—The city council have awarded the contract for machinery for the power plant in connection with the street railway system to the highest of the three tenders sent in—that of the Canadian General Electric Co. for $15,750.

ONTARIO.

Toronto.—The Ice Mfg. Co., Ltd., who are building ice factories at Montreal and Winnipeg, have purchased a site in the north-east section, along the C.P.R. main line to Montreal, and will built an ice factory of 200 tons daily capacity, and ice storage of 50,000 tons capacity. A smaller plant will be built for the west end of the city.

Toronto.—W. H. Thorndyke has his meat market equipped with a 4-ton refrigerating plant by the York Mfg. Co., York, Pa., installed by the Kent Co., Montreal.

Toronto.—The Toronto Municipal Abattoir, construction of which is to begin soon, will provide facilities for private butchers or meat dealers to do their slaughtering, and have their individual chill rooms. There will be three buildings, the abattoir proper, a rendering plant and a power house. The power house will contain refrigerating plant large enough for all requirements of the abattoir.

Burlington.—A fire in the boiler roim is supposed to have been the start of a big blaze which completely destroyed the basket factory of J. W. Dalton, on January 26th.

Dunnville.—The Canadian Engine Co., is having plans drawn for a large addition to be made to its plant for the manufacture of gas and gasoline engines.

Toronto.—The Dominion District Steam Heating Co. asked the controllers recently for a franchise to supply steam through an underground system.

St. Catharines.—The city council have received a quotation from the Hydro-Electric Commission of $14 per horsepower for 2,000 horsepower, the city to install a transformer station and system, estimated to cost $15,000.

Thornsbury.—The Forbes Bros., of Seaforth, Ontario, have the contract for the erection of poles and installing telephones for the Beaver Valley Municipal Telephone System. They commenced operations recently.

Sault Ste. Marie.—The H. E. Talbot Company, of the Soo, have been awarded the contract for the construction of a 1,500-foot dam and the installation of a complete hydro-electric system at Grand Mere, Que.

Hamilton.—The mayor is in favor of a Commission to manage the civic power plant. It is proposed to hold the election in May, and to pay each of the two Commissioners, who, with the Mayor, will make up the Board, $1,000 a year. The question of appointing a Manager has not been dealt with yet.

Galt—The Grand Valley Railway will be overhauled and extended to Port Dover. It will make a specialty of freight traffic, it is believed.

Welland.—The town council have authorized the purchase of the Ontario Power Plant, and will use it in connection with the hydro-electric system. The price is $26.250.

St. Thomas.—Surveyors for the new hydro-electric power line from this city to Windsor, started work on the St. Thomas end on Thursday, Jan. 2. The line will run through Dutton, West Lorne, Rodney, Ridgetown, Chatham and Kingsville.

Orillia.—The town intends to sell its power dam to the Dominion Government for about $100,000. With the money a new power plant will be built, capable of supplying four thousand horse power.

NOVA SCOTIA.

Sydney.—Owing to last year's disastrous drought, the capacity of the water works plant must be increased to connect other lakes with the present supply, a pipe line and pumping station will be required.

Sydney.—The Dominion Coal Company have awarded the contract for the erection of the new 20,000 k.w. electric plant at Waterford to the Siemens Co., of Canada, Ltd.

The Bawden Machine Co., Ltd., Toronto, are giving away what they rightly describe as a beautiful art calendar. It is a most graceful and charming feminine creation by Mr. Frank H. Desch, called 'In Meditation Sweet.' There is the same contrast of strong colors, the same graceful line, the same luxury of tone, the same beauty of modeling, the same exquisite coloring in the face and hair as in 'Lady Caprice,' by the same painter. The Bawden Machine Co. do themselves credit by issuing such a splendid calendar.

The first thing that strikes one on looking at the calendar of the Canadian Tungsten Lamp Co., Ltd., Hamilton, Ont., is that the light from their lamp is intense and above the average. This effect is secured by the picture of a female figure, who holds in her right hand a "Nulite" lamp, and with her left hand shields her eyes from the glare. The background is of azure and green, which gives the white light of the Tungsten lamp a dazzling effect.

Engineering Works of Canada, Ltd., Montreal, have sent us catalogue No. 1 dealing with the firm's line of open type induction motors, in sizes from ½ to 200 h.-p., built with squirrel cage or slip-ring rotor as desired. These motors are built to conform with the specifications of the A.I.E.E., and full details of their construction are given.

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WANTED—CANADIAN REPRESENTATIVE to distribute ice making and refrigerating machinery, internal combustion engines of all kinds, and special machinery of any kind built to order. Cleveland Ice Machine & Mfg. Co., Lorain, Ohio, U.S.A.

BEATH CRANES CHAIN BLOCKS TROLLEYS OVERHEAD RUNWAYS

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Keep our Feet Off Wet Floors
These Mats will prove invaluable to Breweries, Refrigeration Cos., etc. They are made of the best galvanized ribbon steel. No short links. Write for circulars.
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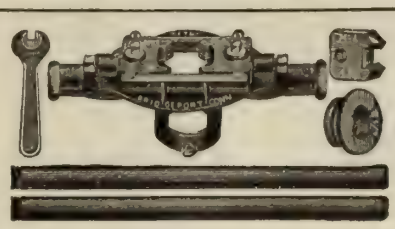
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A more finely ground graphite than No. 1, though of the same stock. This is adapted to close-fitting bearings and delicate mechanism.

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This is a selected grade of Dixon's Ticonderoga Flake Graphite ground even finer than the No. 2 Flake. It is widely used in stationary gas engines. This grade of graphite is also used on type-setting machinery.

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¶ It might be worth hundreds of dollars.

¶ Every issue of "THE POWER HOUSE" is full of practical, helpful ideas. You ought to be able to sift out four each month that would prove of some use to you. Put a value of two cents on each and your subscription has been paid.

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We want your business and guarantee satisfaction.

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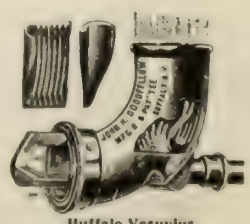
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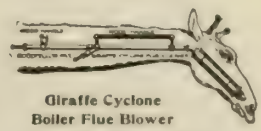
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Boiler Flue Blower
THE WORLD'S BEST
STEAM BOILER TUBE CLEANERS
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Perfect Scraper
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Will you buy some "just as good" lubricant, because some theory seems to prove that it ought to be a good friction reducer?
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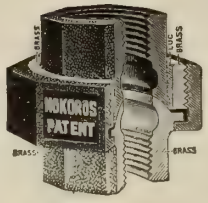

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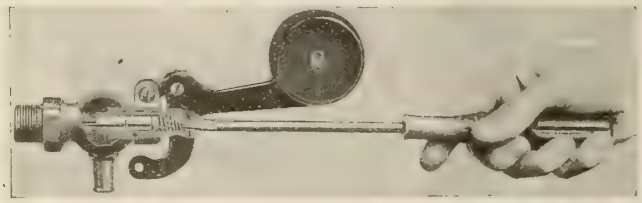

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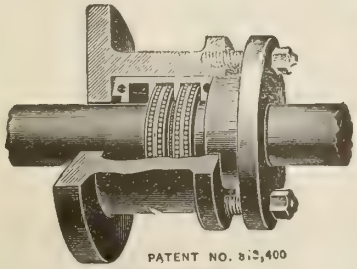

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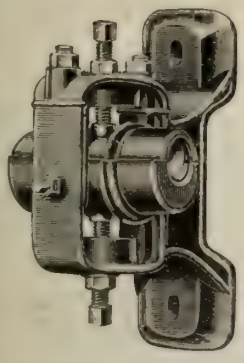

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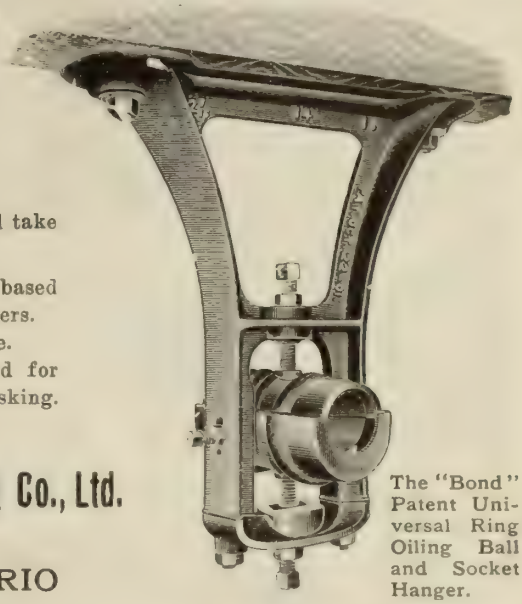

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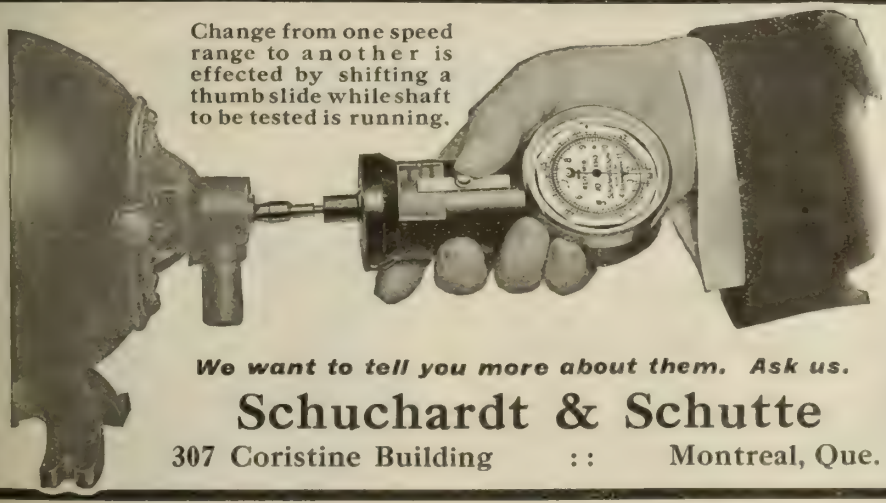

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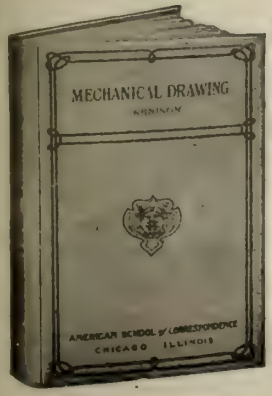

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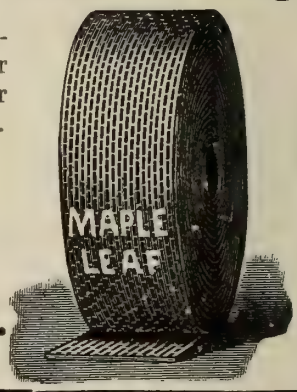

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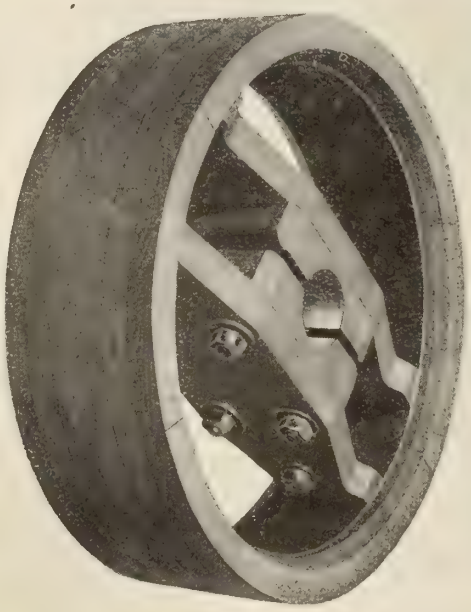

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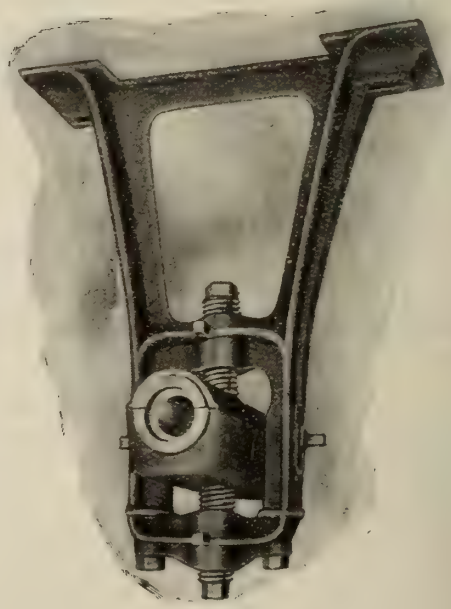

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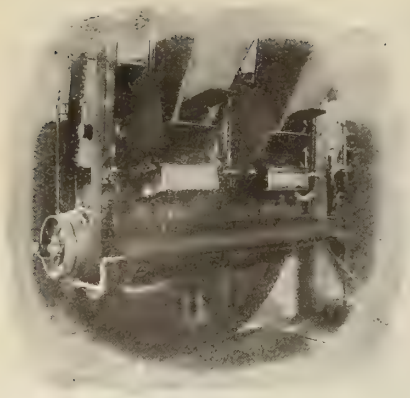

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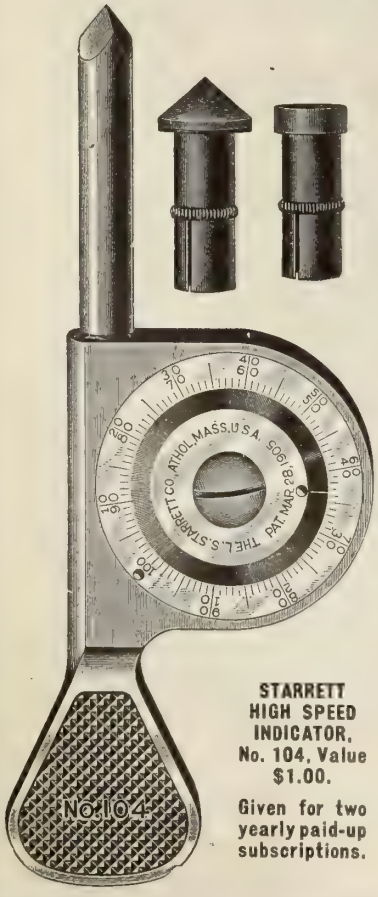

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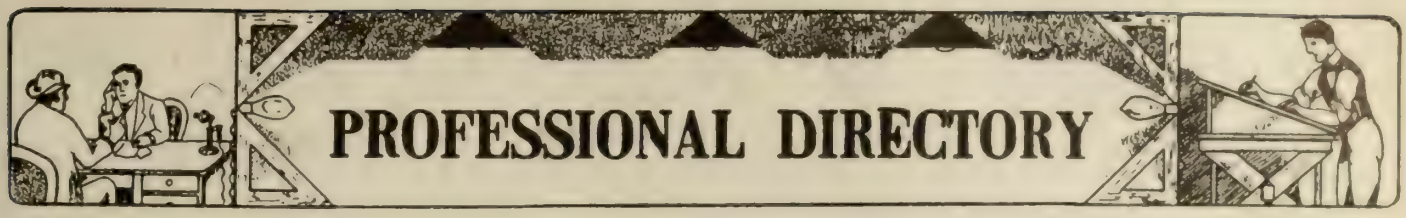

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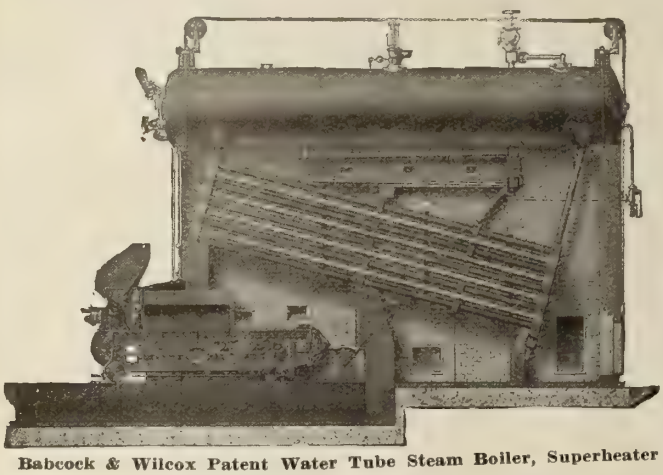

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C. O. Bartlett & Snow Co., Montreal

Buckets.
Manitoba Bridge & Iron Works, Ltd., Winnipeg.

Cable Hangers and Supports.
Standard Underground Cable Co., of Canada, Ltd., Hamilton, Ont.

Cables, Aerial and Underground.
Eugene F. Phillips Electrical Works, Ltd., Montreal.
Standard Underground Cable Co., of Canada, Ltd., Hamilton, Ont.

Cable, Terminals.
Standard Underground Cable Co., of Canada, Ltd., Hamilton, Ont.

Cans, Oily Waste.
Jas. Morrison Brass Mfg. Co., Toronto.

Carbon Brushes.
Rongier Freres.
Lunkenheimer Co., Cincinnati, O.

Car Movers and Pullers.
Manitoba Bridge & Iron Works, Ltd., Winnipeg.

Cast Iron Fittings.
General Supply Co. of Can., Ottawa.
Lunkenheimer Co., Cincinnati, O.

Castings, Brass and Iron.
Lunkenheimer Co., Cincinnati, O.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
J. C. Wilson & Co., Glenora, Ont.

Cement, Fireproof.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.

Cement Machinery.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
C. O. Bartlett & Snow Co., Montreal

Chemicals.
Dearborn Chemical Co., Chicago.
C. C. Snowdon, Calgary.

Circuit-Breakers.
Engineering Works of Canada, Ltd., Montreal.
Can. Gen. Elec. Co., Ltd., Toronto.
Can. Westinghouse Co., Hamilton.

Clutches.
C. O. Bartlett & Snow Co., Montreal
Elmira Machinery and Transmission Co., Elmira.
General Supply Co. of Can., Ottawa.
Manitoba Bridge & Iron Works, Ltd., Winnipeg.
Waterous Engine Wks. Co., Brantford

Coal and Ash Conveyors.
Babcock & Wilcox, Montreal.
Ed. Bennis & Co., Ltd.
Hare Eng. Co., Toronto.
Jeffrey Mfg. Co., Columbus, O.
H. L. Peiler & Co., Montreal.
Geo. H. Tod, Toronto.

Coal Handling Machinery.
C. O. Bartlett & Snow Co., Montreal
Ed. Bemis & Co., Ltd.
Hare Eng. Co., Toronto.
Geo. H. Tod, Toronto.
Jeffrey Manufacturing Co., Columbus.

Cold Storage Architects.
E. J. Greenstreet, Toronto.

Cold Storage Insulation.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.

Condensers.
W. H. Allen Son & Co. Bedford, Eng.
Alberger Condenser Co., New York.
American Steam Pump Co., Battle Creek, Mich.
Canada Fdry. Co., Ltd., Toronto.
Canadian Boving Co., Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
Fraser & Chalmers, Ltd., Montreal.
Goldie & McCulloch Co., Galt.
John McDougall Caledonian Iron Wks, Montreal.
H. L. Peiler & Co., Montreal.
Hare Eng. Co., Toronto.
Waterous Engine Wks. Co., Brantford

Cold Store Doors and Windows.
Jones Cold Store Door Co., Hagerstown, Md.

Condensation Receiver.
G. M. Davis Regulator Co., Chicago.

Conduits.
E. Leonard & Sons, London, Ont.
Can. H. W. Johns-Manville Co., Toronto.

Consulting Engineers.
Bayfield & Archibald, Vancouver, B.C
Chas. Bishop, M.I.C.S.A., Montreal.
de Gaspe Beaubien, Montreal.
W. N. Dietrich, Montreal.
John T. Farmer, Montreal.
Fetherstonhaugh & Co., Montreal.
Walter J. Francis, Montreal.
Jacobs & Davies, Inc., Montreal.
Pratt & Ross, Toronto.
J. M. Robertson, Montreal.
J. M. Shanly, Montreal.
A. V. Tracy-Gould, Montreal.

Contractors, Structural Steel.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Canada Fdry. Co., Ltd., Toronto.

Conveyor Machinery.
C. O. Bartlett & Snow Co., Montreal
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Engineering Works of Canada, Ltd., Montreal.
Jeffrey Manufacturing Co., Columbus.
Waterous Engine Wks. Co., Brantford

Conveyor Belting.
C. O. Bartlett & Snow Co., Montreal

Cooler Doors.
Jones Cold Store Door Co., Hagerstown, Md.

Cooling Towers.
Alberger Condenser Co., New York.

Copper Rods.
Standard Underground Cable Co., of Canada, Ltd., Hamilton, Ont.

Cork Insulation.
Can. H. W. Johns-Manville Co., Toronto.

Cotton Hose.
Garlock Packing Co., Hamilton, Ont.
Quaker City Rubber Co., Philadelphia.

Couplings.
Canadian Boving Co., Toronto.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Dunlop Tire and Rubber Goods Co., Toronto.
Elmira Machinery and Transmission Co., Elmira.
General Supply Co. of Can., Ottawa.
Jeffrey Manufacturing Co., Columbus.
Manitoba Bridge & Iron Works, Ltd., Winnipeg.
J. C. Wilson & Co., Glenora, Ont.

Cranes, Electric.
Babcock & Wilcox, Montreal.
Canada Fdry Co., Ltd., Toronto.
Smart-Turner Machine Co., Ltd., Hamilton.

Crank and Crosshead Pin Oilers
Lunkenheimer Co., Cincinnati, O.

Crushing Machinery.
C. O. Bartlett & Snow Co., Montreal
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundry Co., Ltd., Toronto.
Fraser & Chalmers, Ltd., Montreal.

Damper Regulators.
Darling Bros., Montreal.
G. M. Davis Regulator Co., Chicago, Ill.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
Jas. Morrison Brass Mfg. Co., Toronto.
H. L. Peiler & Co., Montreal.

Detector Phones.
The Maihak Indicator Agency, Montreal.

Doors, Cold Storage and Freezer.
Jones Cold Store Door Co., Hagerstown, Md.

Dry Cleaners Systems.
S. F. Bowser & Co., Inc., Toronto.

Drying Machinery.
Can. Fairbanks-Morse Co., Montreal.

Dynamos.
W. H. Allen Son & Co. Bedford, Eng.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.

Economizers.
Babcock & Wilcox, Montreal.
Can. Fairbanks-Morse Co., Montreal.

Ejectors.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
Smart-Turner Machine Co., Ltd., Hamilton.

Electric Fans.
Canadian General Electric Co., Ltd., Toronto.

Electrical Accessories and Machinery.
W. H. Allen Son & Co. Bedford, Eng.
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Engineering Works of Canada, Ltd., Montreal.
Monarch Electric Co., St. Lambert, Que.
Northern Electric & Mfg. Co., Limited Montreal.
Railway Equipment Co., Toronto.

Electrical Repairs.
Mead Electric Co., Montreal.

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Railway Equipment Co., Toronto.

Elevators.
Engineering Works of Canada, Ltd., Montreal.
John McDougall Caledonian Iron Wks, Montreal.

Elevating Machinery.
C. O. Bartlett & Snow Co., Montreal
Can. Fairbanks-Morse Co., Montreal.
Engineering Works of Canada, Ltd., Montreal.
Goldie & McCulloch Co., Galt.
Jeffrey Manufacturing Co., Columbus.
Waterous Engine Works Co., Brantford.

Engineers' Supplies.
Lunkenheimer Co., Cincinnati, O.
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Engines, Automatic and Drop Valve.
Fraser & Chalmers, Ltd., Montreal.
E. Leonard & Sons, London, Ont.
Robb Engineering Co., Amherst, N.S.
Waterous Engine Works Co., Brantford.

Engines, Corliss and Rocking Valve.
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Jenckes Machine Co., Sherbrooke, Que
E. Leonard & Sons, London, Ont.
Robb Engineering Co., Amherst, N.S.
Waterous Engine Works Co., Brantford.

Engines, Gas and Gasoline.
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General Supply Co. of Canada, Ottawa
E. Leonard & Sons, London, Ont.
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The John McDougall Caledonian Iron Works Co., Ltd., Montreal.

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W. H. Allen Son & Co. Bedford, Eng.
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E. Leonard & Sons, London, Ont.
John McDougall Caledonian Iron Wks, Montreal.
Kerr Engine Co., Walkerville.
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Excavators.
C. O. Bartlett & Snow Co., Montreal

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Lunkenheimer Co., Cincinnati, O.

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W. H. Allen Son & Co. Bedford, Eng.
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General Supply Co. of Canada, Ottawa

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Hare Eng. Co., Toronto.

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Ohio Brass Co., Mansfield, Ohio.
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W. J. Wall, Montreal.
Garlock Packing Co., Hamilton, Ont.
Lunkenheimer Co., Cincinnati, O.

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Lunkenheimer Co., Cincinnati, O.
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Jenkins Bros., Ltd., Montreal.
The Lunkenheimer Co., Cincinnati, O.

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Smart - Turner Machine Co., Ltd., Hamilton.
J. C. Wilson & Co., Glenora, Ont.

Gears, Spur Level.
Manitoba Bridge & Iron Works Limited, Winnipeg.
J. C. Wilson & Co., Glenora, Ont.

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W. H. Allen Son & Co. Bedford, Eng.
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The Maihak Indicator Agy., Montreal.

Indicators—Ammonia, Hydraulic.
Detroit Lubricator Co., Walkerville.

Indicating.
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Darling Bros., Montreal.
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Jas. Morrison Brass Mfg. Co., Toronto.

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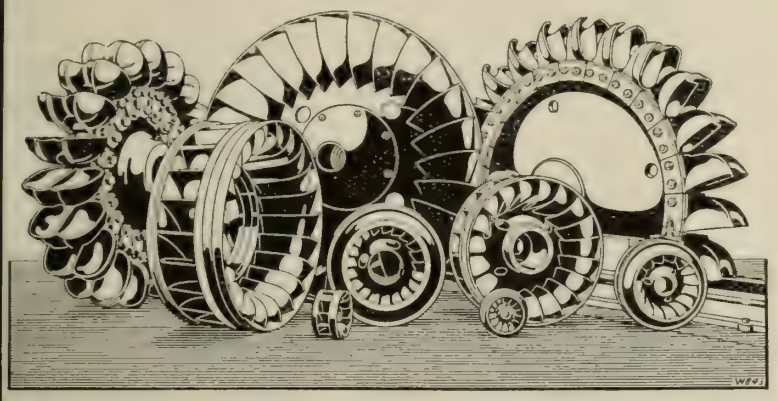

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Garlock Packing Co., Hamilton, Can.
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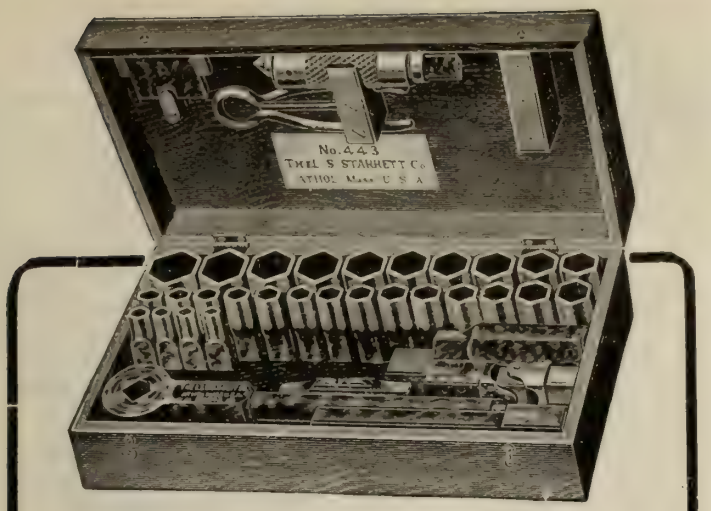

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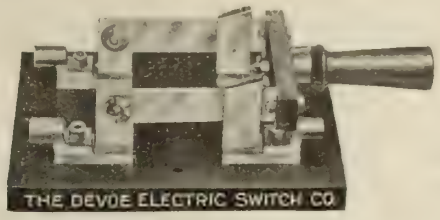

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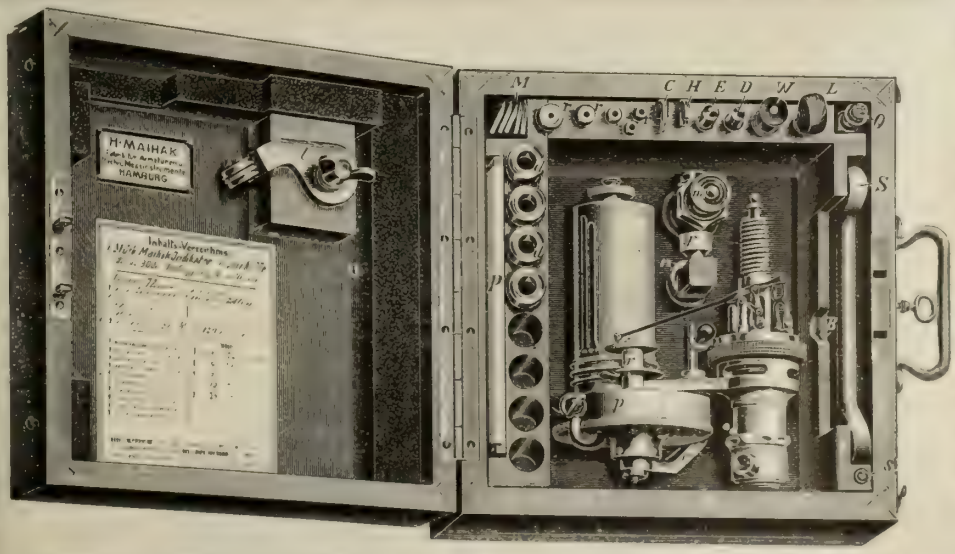

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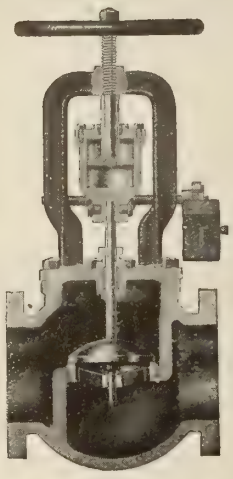

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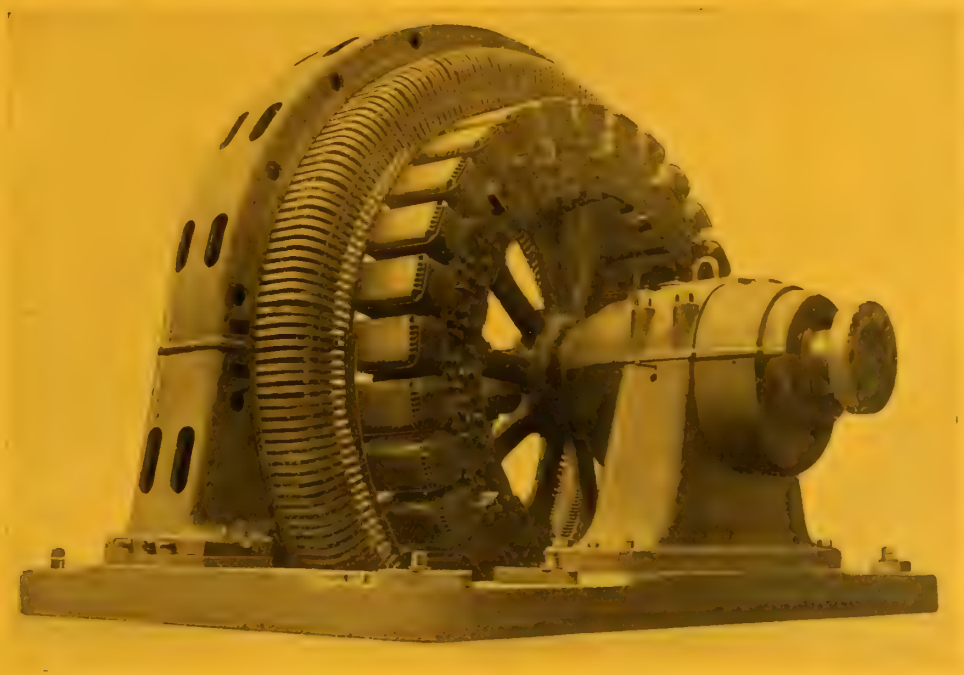
Westinghouse
Water-Wheel Generators



Westinghouse 5000 Kva. Alternating Current Water Wheel Generator, showing method of exposing revolving field for inspection or repair, without dismantling the frame.

Reliable—Durable—Efficient

Reliability. Westinghouse Water-Wheel Generators are establishing remarkable records for satisfactory service. Each and every one has to demonstrate its fitness for future service by undergoing careful, thorough and rigid tests in the shop before shipment.

Durability. Many years experience, enables us to select the materials which wear the longest, and these are used in the construction of Westinghouse Water-Wheel Generators, regardless of first cost.

Efficiency. Ideal design, suitable materials and skilled workmanship result in the highest sustained operating efficiency.

Estimates on water-wheel generators of any capacity, speed and voltage will be gladly furnished. Write nearest district office for full particulars.

Canadian Westinghouse Co., Ltd, Hamilton, Ontario

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Traders Bank Bldg.

MONTREAL
52 Victoria Square

OTTAWA
Ahearn & Soper, Ltd.

HALIFAX
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WINNIPEG
158 Portage Ave. E.

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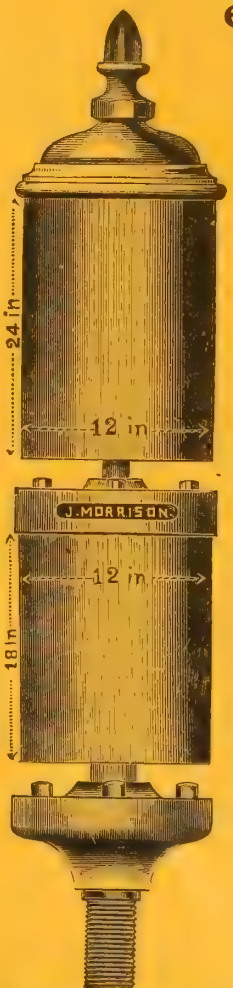
STEAM GOODS
Of The
UTMOST RELIABILITY

TRADE MARK J.M.T. REGISTERED
A GUARANTEE OF QUALITY

They Are The Result Of Long Experience And The Embodiment Of The Highest Grade Material.



We make a large variety of Steam Whistles from 1 inch diam. to 14 inches diam.—for all uses.

Morrison's Steam Goods have an established reputation among engineers and are recognized by all who know as the right line to use—the line that saves time, worry and money — the line that gives *real* service economically.

Our products are guaranteed to be just as we claim—you take no chances when the goods are Morrison's.

We have everything in boiler-room accessories.

If interested in any special articles, it will pay you to communicate with us, and get particulars and prices.

J.M.T. Globe Valve

J.M.T. Injector (Improved)

J.M.T. Pop Safety Valve
Made Flanged and Screwed

The James Morrison Brass Mfg. Co.
Limited

93-97 Adelaide Street West - - TORONTO

ALPHABETICAL INDEX ON LAST PAGE

BUYERS!—Refer to our Classified Index of Articles Advertised on last few pages

THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power; and to the operation of Refrigerating Machinery.
Published by The MacLean Publishing Co., Limited.

MONTREAL: Eastern Townships Bank Bldg. TORONTO: 143 149 University Ave. LONDON, ENG.: 88 Fleet St. E.C. WINNIPEG: 34 Royal Bank Bldg.

Vol. VI. Publication Office, Toronto—March, 1913 No. 3

TRADE PENBERTHY MARK

Automatic Cellar Drainer

Specially adapted for use in pits, sumps, cellars, tanks, settling basins or wherever it is desired to keep water or other liquids from going above a certain level.

SIMPLE--COMPACT--ECONOMICAL

FAR superior to any other device of its kind on the market.

Some Advantages

1. All parts except the float are above the water, no slime or corrosion to contend with.
2. The operating valves open and close instantly by action of the water pressure.
3. It is compact, taking up less than half the space of others and weighs less, for the same capacity.
4. It costs less than many other drainers not as efficient.

Protect yourself from the damages of Spring floods and rains. Install the Penberthy Cellar Drainer.

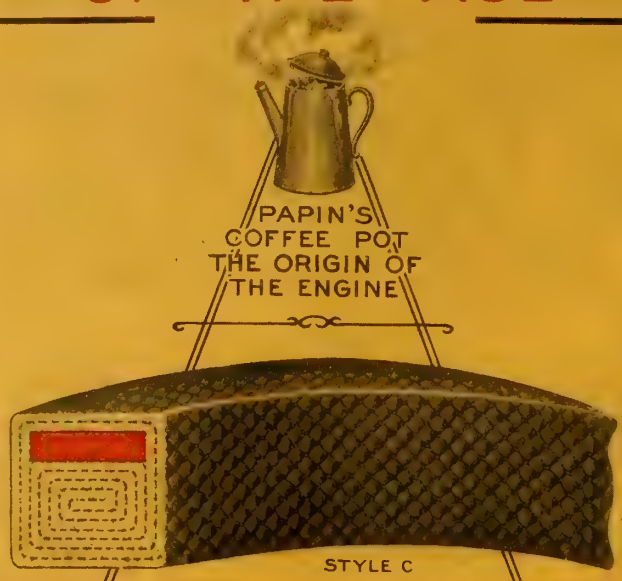
Interesting booklet on request.

MANUFACTURED BY

PENBERTHY INJECTOR CO., LIMITED
WINDSOR, ONTARIO

WE ALWAYS KEEP IN LINE WITH THE IMPROVEMENTS OF THE AGE

FROM THE GENERATION OF STEAM TO THE LAST WORD IN STEAM MAKING APPLIANCES, NOTHING HAS BEEN MADE SO NEAR PERFECTION AS RAIN-BESTO PACKINGS FOR PISTONS OF HIGH SPEED ENGINES.



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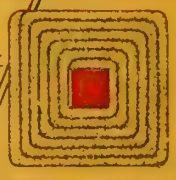

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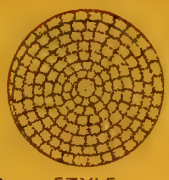
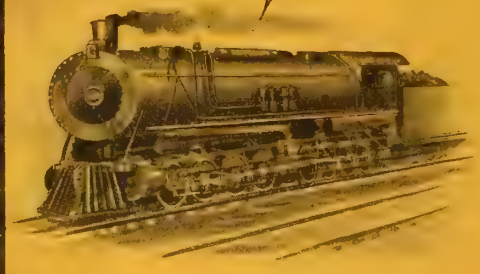
THE FINEST MATERIALS



A COMBINATION OF THE BEST LONG FIBROUS ASBESTOS CLOTH MADE AND A CORE OR CUSHION OF THE CELEBRATED RAINBOW PACKING COMPOUND IS UNEQUALLED FOR EXTREMELY HIGH PRESSURES.



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H. D. EDWARDS & CO.

DETROIT, MICH.

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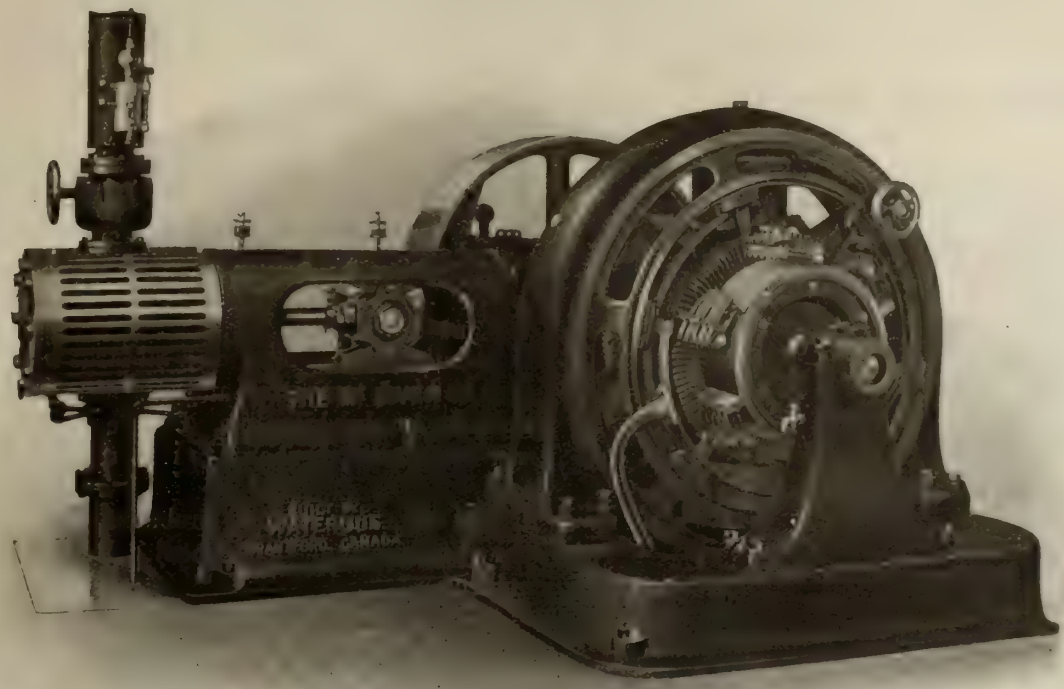


A McEwen In Your Plant

A McEwen Automatic Engine in your own power house will not only develop all your electric light and power as cheaply as you can buy it from outside, but will supply you with this power continuously.

There are no shut-downs because "something has gone wrong on the transmission line."

Simplicity of operation, economy in steam consumption and the ability to stand up under hard usage—are features that make the McEwen Engine ideal for Isolated Plant Installation.

Both Simple and Compound types are built. Sizes range from 40 to 700 H.P. Every McEwen Engine is Canadian built throughout. It is tested and inspected before leaving the works and is backed up by a rock bottom regulation guarantee, that in plain English means **"Satisfaction or your money back."**

Write for booklet for full particulars.

Our Isolated Plant Equipment

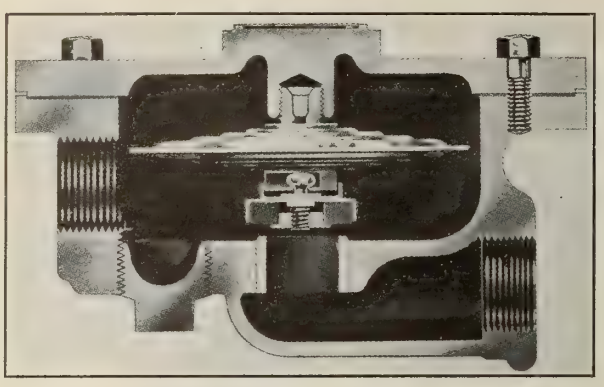
McEwen Automatic Engines.
Waterous Boilers—any style.
Feed Water Heaters.
Injectors.
Steam Separators.
Circulating Pumps.
Feed Pumps.
Exhaust Heads.

The Waterous Engine Works Co., Limited

BRANTFORD, CANADA

The advertiser would like to know where you saw his advertisement—tell him.

The Dunham Blast Trap passes more water and saves more steam for its size than any trap on the market to-day.



DUNHAM BLAST TRAP

Let us prove it to You

Ask About It

Especially adapted for use on all large heating units, such as blast, tempering and reheating coils, heating units for lumber kilns, etc. Can be used on low pressure system and discharge to vacuum pump or sewer.

If you have any heating problems, put them up to our Engineering Department. It will cost you nothing.

C. A. DUNHAM CO., Ltd. TORONTO, CAN.

Halifax Montreal Vancouver Calgary Edmonton

Sales Over Five Million Dollars Annually

Four Babbitt Manufacturing Plants

TORONTO LONDON, ENG. NEW YORK ST. LOUIS

Faultless "A" This babbitt is a high grade copper hardened alloy, possessing in a higher degree all the good points of the original Genuine Babbitt, with increased antifriction qualities, having the additional merit of absorbing and holding oil. It is used extensively in France for automobile engines, and in South Africa for mining machinery, and in United States and Canada for marine engines, dynamos and all heavy duty machines. Where heavy service is required this will last longer than any Genuine Babbitt manufactured. For heavy duty, saw mills and engines it is without equal.

Eagle "A" Thousands of tons of this alloy have been placed on the market, giving such perfect results, that it's name and merits are known, we believe, as extensively as any other babbitt manufactured. Its high antifriction and heavy duty qualities make it especially adapted for saw-mills, planing-mills, threshing engines, traction engines, pumps, rolling-mills and general machine shop use.

HOYT METAL COMPANY

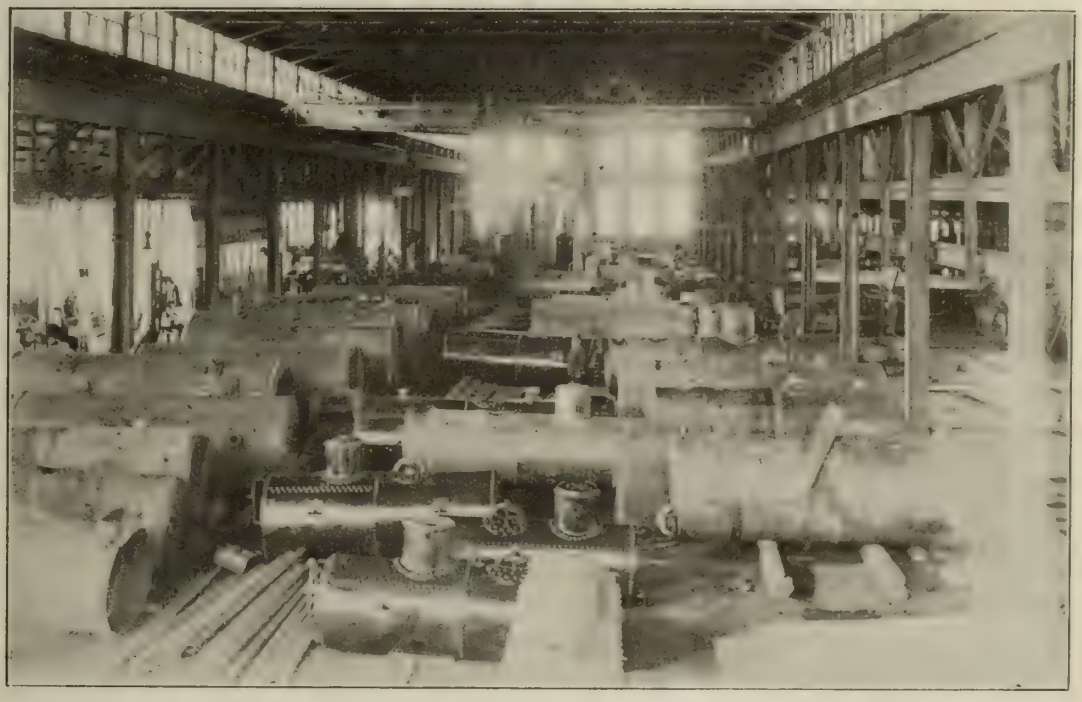
TORONTO OFFICE AND MFG. PLANT—EASTERN AVE. AND LEWIS ST.

The advertiser would like to know where you saw his advertisement—tell him.

When it Comes to Quality, Efficiency, and Economy

JENCKES BOILERS

Are Leaders



¶ The photo shows the interior of our Boiler department, with Boilers in various stages of construction.

¶ We have facilities for turning out Boilers to meet every requirement on short notice. Our Boilers are made to conform with the various Provincial Inspection Acts.

¶ Every one has to pass a rigid inspection and test under high pressure, and must be right in every way before leaving the works.

Let us go into details with you regarding "JENCKES" construction.

WRITE TO-DAY.

The Jenckes Machine Co., Limited

Sherbrooke Montreal St. Catharines Cobalt South Porcupine Nelson Vancouver

Works: SHERBROOKE, QUE. ST. CATHARINES, ONT.

Make Up Your Mind to Make More Money

and avoid a lot of trouble by stopping **promptly, positively** and **permanently** every leak in pipe joints throughout your plant. We'll show you **how** to do it and we'll **prove** that our method **will** do it, **before** we take a cent of your money. We'll prove this right **in your own plant**—under your own eyes—on the **worst joints** you have—under highest pressure or temperature—in service even with **highly super-heated** or **saturated steam**, and on **long lines.** We'll do this by sending you

A Supply of Goetze's No. 2 Gaskets On 90 Days' Trial Entirely at *Our* Risk

Then, it will be up to you to give them a try-out that will show either that you don't want a Goetze's No. 2 Gasket in your plant, or that you want one of them in **every** flanged pipe joint you own. And **one** in a joint is enough—yes, even where **several** of some other kind have failed to hold. Goetze's Elastic Corrugated Copper Gaskets, with Asbestos Lining No. 2 ("Goetze's No. 2," for short) **cannot** blow out, burn out or give out in **any** way. No other one thing can save you as much trouble, time, coal, money.

If our claims are true, you can't afford to be without Goetze's No. 2 Gaskets. If they are not true, you can disprove them at **our** expense. Send for a supply of Goetze's No. 2 Gaskets to-day, and find out for yourself, once for all, **now.**

Do **You** Have the Usual Leaking Valves in **Your** Plant? Have **you** found it difficult to get a valve gasket that would pack tight and not go to pieces after a few days' or weeks' service? Are you sufficiently tired of such trouble and expense to try a Valve Gasket that comes to you with a **guarantee?**

If we can't prove every word of every claim, we don't want your money.

Are you **willing** to try such a Valve Gasket at **our** risk?

Then Write Us—To-Day—For A Supply Of Goetze's Copper Valve Gaskets on 90 Days' Trial

and **try** them.

Goetze's Copper Valve Gaskets are for valves of Jenkins and similar types. They are made from **chemically pure copper,** with a core of the **best Asbestos.** These materials form a cushion with sufficient elasticity to insure tight closing, yet with the firmness and strength to resist the heat and pressure which so quickly disintegrate and destroy ordinary rubber or "composition" gaskets. The valve seats will close **tightly** on **this** gasket without injuring it or themselves.

You can put them in without removing valves from piping. **And then you can forget them.**

Made of **Nickel** and Asbestos if you want to use them with acids, etc.

Send for a supply of Goetze's Copper Valve Gaskets and **try** them for 90 days at **our risk.** Merely give sizes wanted, number of each, and whether with **two** flat sides inside, or with round hole.

Ask for Catalog of Packings for All Power Plant Purposes.

Goetze Gaskets are carried in stock by

T. McAVITY & SONS, LIMITED

St. John, N. B.

BRANCHES AT

MONTREAL
112 St. Peter Street

WINNIPEG
C. E. Chown, 147 Bannatyne Street

VANCOUVER
c/o A. O. Campbell, 1069 Hamilton Street

MANUFACTURED BY

Goetze-Gasket & Packing Co.

NEW BRUNSWICK, N.J.

You can buy cheaper packing, but you cannot buy as good

"This Book Showed Me How To Reduce The Coal Bill"

Every engineer knows that a leaky or improperly-set slide valve will waste a whole lot of steam and run up a big coal bill. We've an 88-page book—fully illustrated—that tells most of the things that are known about the slide valve. You may have a copy, FREE, if you will fill out and mail the coupon, then comply with the easy requirements stated therein.

Positively no book will be sent unless the coupon is completely filled out and returned to us.

DANIEL'S ROD PACKING **P. P. P.** COIL RING SPIRAL

will pay for itself many times over, both in increased service and by reducing the unnecessary friction on the rod. Scientific tests show that this saving is in excess of 75%, and that coal bills have been reduced from $100.00 to $500.00 yearly.

Prove this to the "old man" and throw out the hint that, at least, a part of this saving should go into your pay envelope.

Daniel's P. P. P. Rod Packing is imitated more than any other packing on the market, but only the genuine gives the results. P. P. P. makes rods as smooth as glass; holds on scored and pitted rods; requires only your fingers to tighten the gland, and lasts for months—often for a year or more.

Order enough P.P.P. from your dealer to pack a single stuffing-box, one time—we will wager that you will use no other. Why not do this TO-DAY?

How To Get The Valve Book Free

Fill out the Coupon, and mail it to us. We will address a book to you, and send it to your dealer, who will hand it to you, FREE of charge, when you call at his store and look at Daniel's P. P. P. Packing.

Your Name .....
Address .....
Employed by .....
Address .....
Horsepower of Engine .....
Kind of Rod Packing Used .....
Do you use EBONITE Sheet Packing? .....
Dealer's Name .....
Address .....
Who buys your supplies? ..... Series 24 C-V

If your dealer doesn't carry P. P. P. we will write telling you who does, and the book will be sent to the dealer we name. Please do not call for book until we notify you.

FREE to Users of P.P.P.

If you are a user of Daniel's P.P.P., fill out the coupon and mail it to us with the Big Red D—cut from the box lid—and a testimonial letter of your experience with the packing. We will mail you a FREE copy of "The Slide Valve" direct. You'll not be required to go to your dealer for the book. Don't forget the letter.

QUAKER CITY RUBBER COMPANY

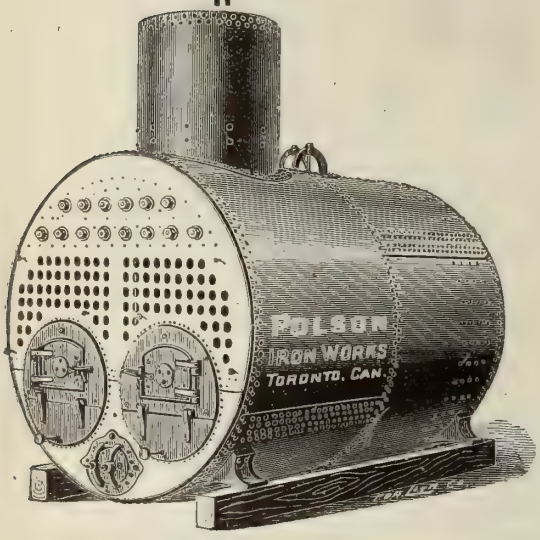
Manufacturers of Mechanical Rubber Goods
PHILADELPHIA, Pa., U.S.A.

MARINE BOILERS

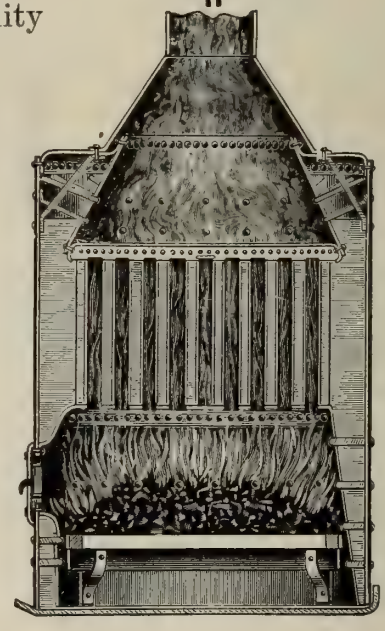
LAND BOILERS

The Utmost in Boiler Efficiency

From start to finish these boilers are under the supervision of experts, and are made by men with long experience. Only the best materials are used, so as to ensure a boiler of unusual durability and safety.



It will pay you to communicate with us and get full particulars. You may need a new boiler soon, and you will want the best.



We build various types:

Scotch, Clyde, Fitzgibbon, Vertical, Mosher.

Horizontal Tubular, Vertical, Locomotive Type, "Heine" Water Tube

GENERAL PLATE WORK

POLSON IRON WORKS, LIMITED

STEEL SHIPBUILDERS, ENGINEERS AND BOILERMAKERS

TORONTO **CANADA**

REPRESENTATIVES IN CANADA FOR

The B. F. Sturtevant Co., Hyde Park, Mass., U.S.A., Fans, Blowers, Heating and Ventilating
The John I. Thornycroft Co., London, England, Marine Motors

The advertiser would like to know where you saw his advertisement—tell him.

Why is it Most Flue Cleaners Run so Hard?

Because the rub is almost Square Across the Flue.

This one big objection has been entirely removed in the construction of

The Garlock Common Sense Flue Cleaner

This cleaner has a long shearing cut, making it the easiest running cleaner on the market to-day.

It **shaves** the carbon off, cleaning the flue **perfectly.**

It is adjustable to wear, because the wear comes on the cutters, **not** on the frame, never sticks in a flue, passes all welds or collapses, and can be easily sharpened by passing a file over the knives.

Most cleaners fail to get the flue clean, because they only **rub** the carbon **baked** on the flue and it **cannot be rubbed off.**

Garlock Common Sense shaves clean every time. This reason and because the temper in the material of the Common Sense will stand cleaning **hot** flues commends it to **Every Engineer.**

Write for literature and price lists.

The Garlock Packing Company

Head Office and Works: HAMILTON, ONT.

Branches :

WINNIPEG
181 Market St. E.

TORONTO
77 Adelaide St. E.

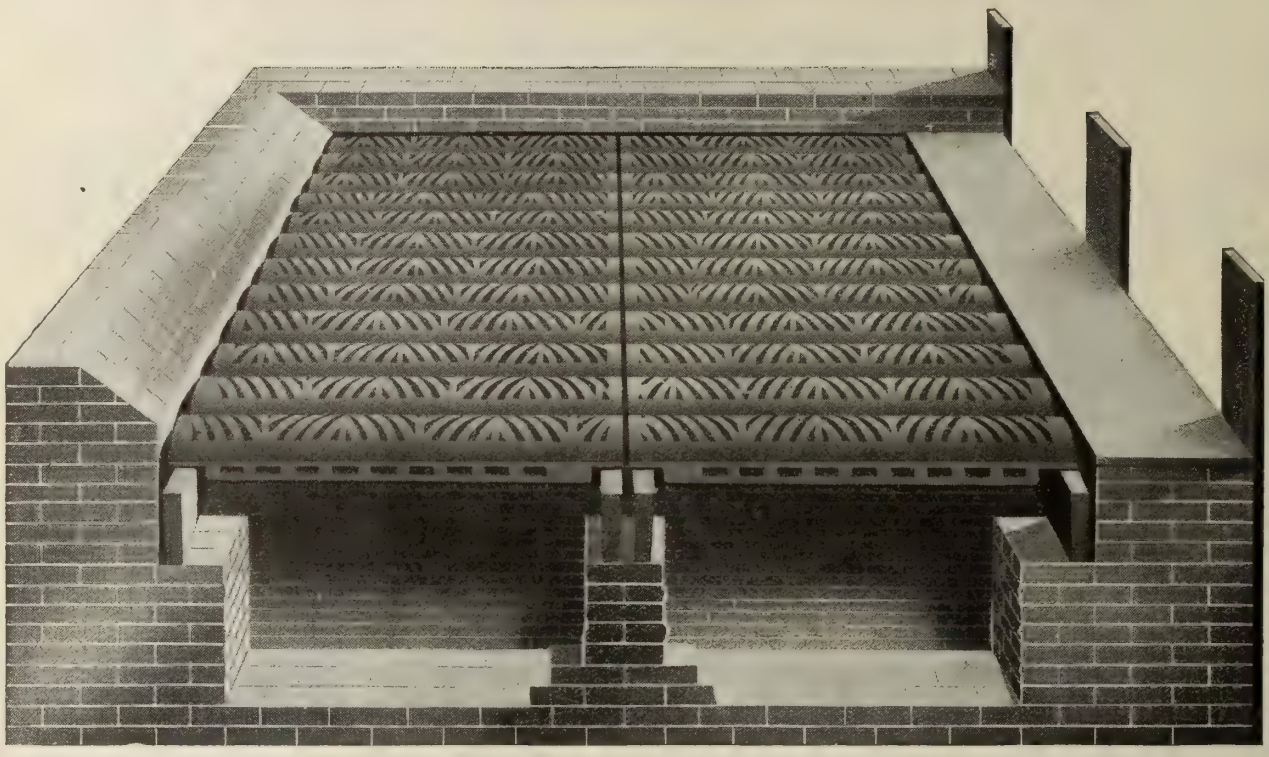
MONTREAL
412 St. James St.

"PIONEERS IN THE PACKING BUSINESS."

THOMAS ELLIPTIC GRATE BARS

SHAKING—CIRCLE—STATIONARY

FOR EVERY FUEL



THOMAS IDEAS

PATENTED

THOMAS ELLIPTIC GRATE BARS	INCREASE STEAM—SAVE FUEL—SAVE LABOR —COST LESS—REDUCE SMOKE.
THOMAS GRATE RESTS	EVERLASTING—PRESERVE GRATE BARS—PROTECT FIRE WALLS.
THOMAS FURNACE SETTING	FIRE WALLS—BRIDGE WALL—FRONT WALL independent of all expanding and contracting irons. SEE THAT AIR SPACE COMPLETELY ENCIRCLING THE GRATE AREA. No dead and burned grate bar ends. No pushed down walls from expansion of grates.

Shipped from Hamilton, Ont.

Let us give you complete information.

FOR ALL PROBLEMS

Steam—Grate Bar—Furnace—write THOMAS

The General Supply Co. of Canada, Ltd.

OTTAWA TORONTO WINNIPEG

THOMAS GRATE BAR CO., **Birmingham, Ala., U.S.A.**

The advertiser would like to know where you saw his advertisement—tell him.

"THE Cyclone"

Shaking and Dumping Grate Bar

The Grate That Has Many Imitations

Our competitors admit the superiority of this Grate Bar by imitating it.

Their Grates work on about the same principles, but are away off when it comes to a point of quality, efficiency, economy and durability.

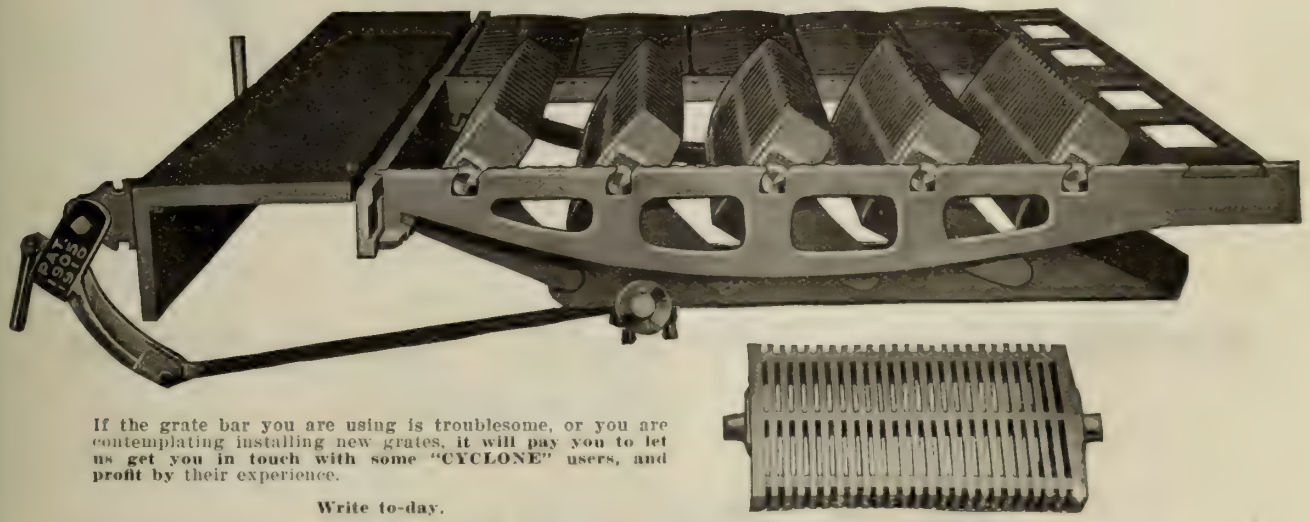
Our grates are the embodiment of the **Highest Grade Material** and our special methods which have been developed during the many years that we have been manufacturing Grate Bars.

Efficient, Durable and Economical

The "CYCLONE" has proved that it generates more steam from less fuel than any other. It has also proved that it burns the cheapest grades of fuel with results equal to that of the best grades.

The improved shaking mechanism means more vigorous and effective shaking, and prevents any ashes from clinging to the centre of the grate.

The "CYCLONE" is the Grate that locks level—the one grate that cannot get out of adjustment or become warped.



If the grate bar you are using is troublesome, or you are contemplating installing new grates, it will pay you to let us get you in touch with some "CYCLONE" users, and profit by their experience.

Write to-day.

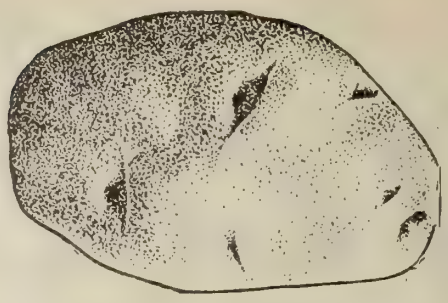
CANADIAN STEAM BOILER EQUIPMENT COMPANY, Ltd.

SOLE MANUFACTURERS FOR CANADA

211 QUEEN STREET EAST :-: :-: :-: **TORONTO, CANADA**

AGENTS

ST. JOHN, N.B., F. W. Blizard, Canada Permanent Chambers. MONTREAL, H. L. Peiler & Co., 308 St. James Street.
HAMILTON, Robt. Fitzsimmons, 8 Grove Street. CALGARY, Alta., The Western Foundry & Metal Co., Limited.
BERLIN, J. Hainsworth, 14 Foundry Street. WINNIPEG, Vulcan Iron Works.

POTATO  SCALE

A Positive SCALE Remover

Absolutely Non-Injurious to Tubes, Etc.

BOILER CLEANSER

This is the most economical way to clean boiler tubes.

By putting a very small quantity in your feed water daily, you will keep your tubes perfectly clean.

This compound removes old scale in a short time and **prevents pitting, corrosion, foaming, etc.**

We embody no chemicals which are injurious to metal when preparing this boiler cleanser.

Send us a gallon of feed water and **we will mix a quantity for your approval.** If not satisfied **it will not cost you a cent.**

Numidian Cylinder Velox Engine Sliptivity Machine

Three Oils of Unexcelled Quality

Give Them a Trial ***Our Prices are Right***

C. C. SNOWDON

Refiner, Importer and Manufacturer of

Pennsylvania Lubricating and Refined Oils, Gasoline, Potato Scale Powder, Liquid Soap, Disinfectants, Polish, Waste, Oil Tanks, Etc.

1810-1840 11th STREET EAST, CALGARY, ALBERTA

P. O. Box 1384

BETTINGTON BOILERS

HOW MUCH DOES IT COST YOU FOR STEAM?

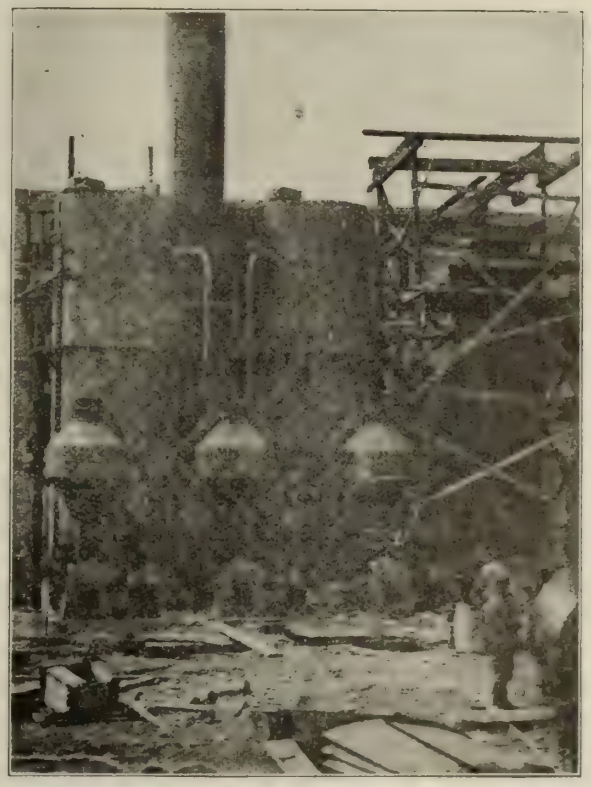
HOW MUCH FUEL REMAINS IN YOUR ASH?

HOW MUCH UNCONSUMED VOLATILE IS GOING UP YOUR STACK?

IF YOU ARE BURNING SLACK COAL ARE YOU OBTAINING THE MAXIMUM EVAPORATION FROM IT?

REASONS WHY THE BETTINGTON SYSTEM WILL CUT DOWN YOUR FUEL BILLS

1. Analysis of the ash shows no carbon.
2. Volatile is all consumed.
3. Cheap coal containing as high 35% ash can be burned with the highest efficiency.
4. Stand by losses eliminated.
5. The cheapest grades of coal can be used.
6. Less labor required.



Bettington Boilers in course of erection for Dominion Coal Co , Ltd.

OPERATING ADVANTAGES OF THE BETTINGTON SYSTEM

1. No grates.
2. No fires to clean.
3. Less ash to handle.
4. Fuel supply quickly adjusted to demand for steam.
5. No smoke.
6. No stand by boilers with banked fires necessary to take care of peak loads.
7. Full load can be obtained in 30 minutes from a cold boiler.

THE BETTINGTON SYSTEM of burning pulverized fuel gives all the advantages of gas fired boilers, and 80% thermal efficiency with the cheapest fuel can be continuously obtained.

FRASER & CHALMERS

LIMITED

Canadian Branch:

4 PHILLIPS PLACE .:. MONTREAL, P.Q.

TRADE JENKINS MARK
Jenkins Bros

Here's a Catalog

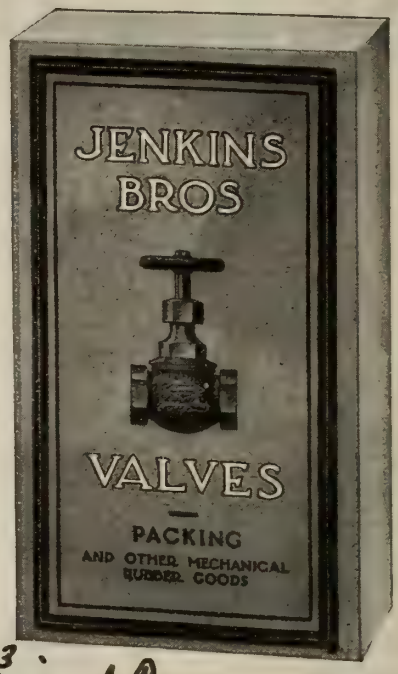
You Ought

to have—

The new

Jenkins Bros.

Catalog for 1912



April 30th 1913
2 Cuts Delivered By.
W. L. Walker

It shows some new types of valves, including the new TYPE "K" brass and iron body gate valves; cast steel valves of extra heavy patterns for superheated steam and hydraulic service, extra heavy check and blow-off valves, automatic equalizing stop and check valves, additional styles of radiator valves—

As well as the standard Jenkins Bros. types you have known and used for years.

Compact—handy—brimful of information for the man who's interested in valves, packing and other mechanical rubber goods for the power plant.

Send for your copy to-day.

Jenkins Bros., Limited

103 ST. REMI STREET

MONTREAL

NEVER LEAKS

NEVER CORRODES

SAVES TIME

The Dart

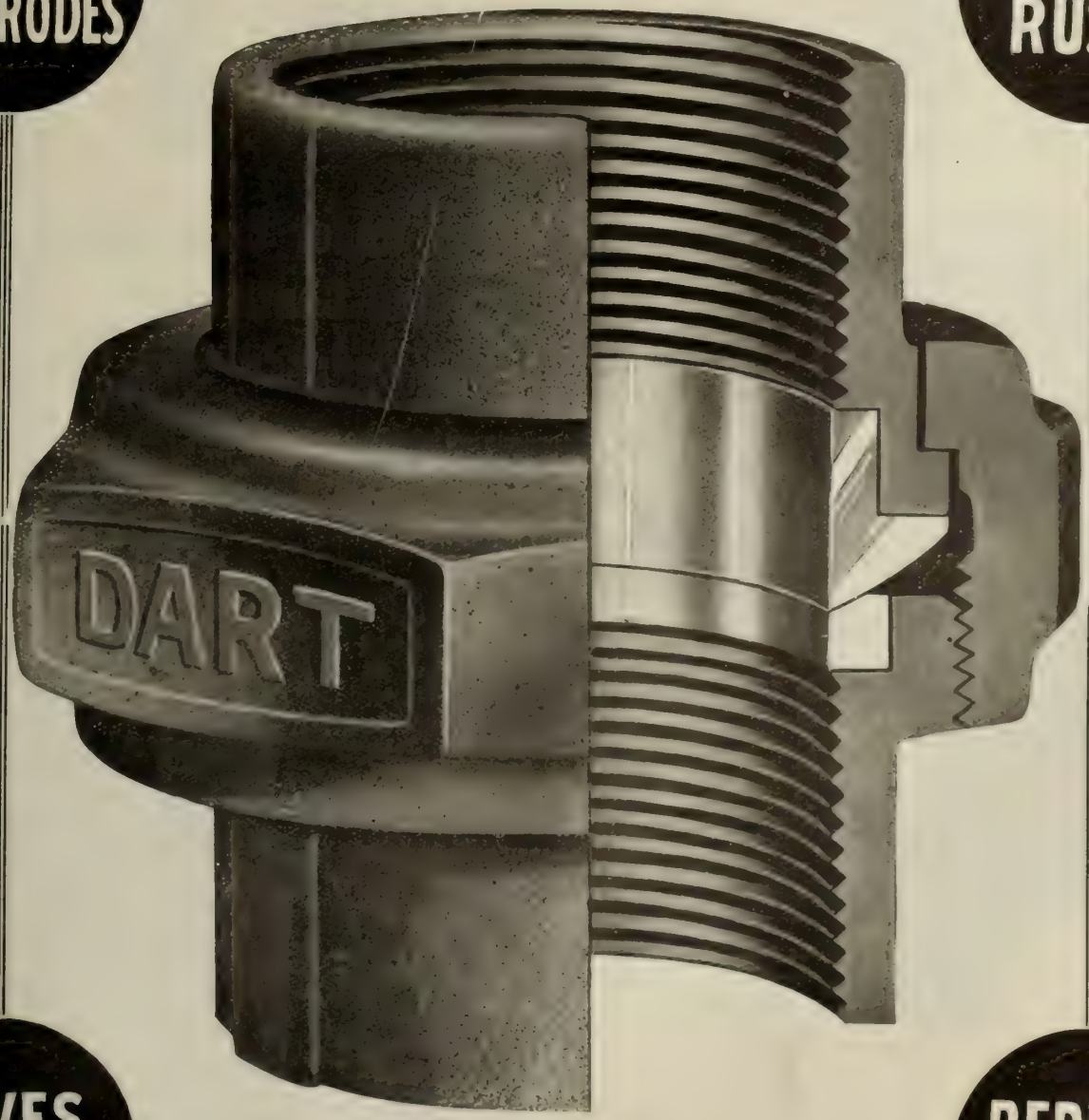
EASILY CONNECTED

NEVER RUSTS

REDUCES EXPENSE

Union pipe coupling that is defective in any way will be replaced two for one.

Nearly all jobbers sell Dart Unions.



Dart Union Co., Limited

TORONTO, CANADA

The advertiser would like to know where you saw his advertisement—tell him.

SAVE 50%

By Using
GREASE AS A LUBRICANT
In The

"PHILADELPHIA" GREASE CUP

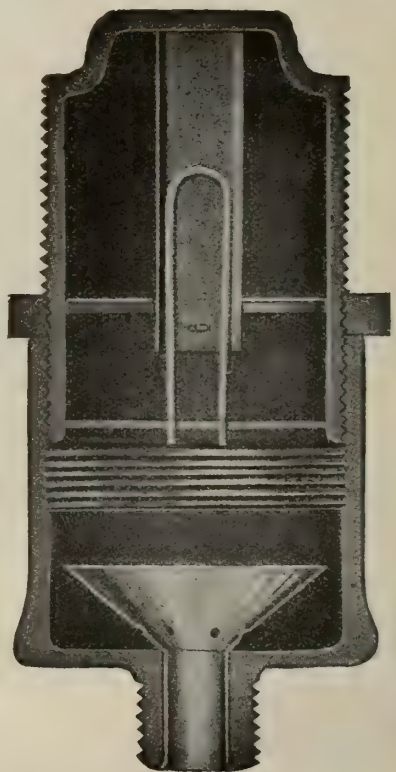
Automatic Feed Under Compressed Air
Slow And Continuous
No Oil Drips—Reduced Fire Hazard

Unexcelled for Lubricating Loose Pulleys, Crank Pins and all classes of Extremely High Speed and Heavy Running Machinery.

In the "Philadelphia" Grease Cup System of lubricating there is no friction, no piston or spring is used, just a thin metal disc resting lightly on the grease to keep it level.

Air pressure above and the needs of the journal below are all that is required to give perfect lubrication. Grease does not change in the slightest, while in the **"Philadelphia" Cup**; the last drop is as good as the first.

There is a large unrestricted outlet and a regularity of action which permits feeding of grease of any thickness.



We guarantee a saving of at least 50% over any other system. You must be perfectly satisfied before you pay a cent.

Our Booklet tells more about it —. write to-day.

Peterborough Machine & Lubricator Co., Limited

PETERBOROUGH, ONTARIO

Scene in the plant of the J. G. Brill Co., at Philadelphia, Pa. Above is shown the gravity tank with wall indicator from which oil flows automatically to feed and drip cups on dynamo bearings of the engine.

How an Efficient Oiling System Pays for Itself in a Year

Here are the figures from one plant which earned more than 100% dividends in one year:

3-500 K. W. Engines, average full load 12 hours; 300 days per year, Coal consumption 10 lbs. per K.W. hour. 27,000 tons of coal at $2.20 per ton, including handling, $60,400.00; 5% frictional savings....	$3,020.00
Difference between 24 and 6 bbls. of oil at .40	435.00
Saving in journal repairs	80.00
Shut downs, loss of labor materials Profits	75.00
15 years' life added to engines, valued at $100,000.00	1,500.00
20% time of oilers	240.00
Total savings	$5,350.00
Cost of system to effect these savings, including oil guards, cups, piping and installation	$2,675.00

In this plant every drop is conserved wherever possible. These pumps and separators keep a clear, clean stream constantly circulating to all bearings.

Why Executives Should Know About Oiling

If men waste time—if factory equipment is being worn out by improper treatment—if friction is dissipating power in transmission apparatus—manager or superintendent is quick to apply a remedy. Yet, because the care of oil is mainly an engine room duty, the factory executive too often overlooks opportunities for savings similar in character and often larger in amount than those directly related to production.

Here are logical economies in the use of oil which every man responsible for a plant's output should know about.

ANALYZING the monthly expense report, the agent of a New England textile mill was struck with the size of the oil bill. Looking back over a number of years, he found that this item had been steadily growing. So he determined to investigate.

He called in the Engineer and together they carefully went over the situation. They agreed that so far as the use of oil was concerned, more than ordinary care was being taken. Little oil was wasted. And, to all intents, the most suitable kind of oil was being used. Still the executive wasn't satisfied. He went farther. He studied methods of handling oil—the oiling equipment. And to make a long story short, he was finally rewarded by a saving of several thousand dollars a year.

What the installation of up-to-date methods meant to this plant is typical of the economies many a factory executive can bring about by the application of scientific principles to this too often neglected problem.

"The Way We've Always Oiled"

The trouble to-day in many a power plant is the feeling that "What we've always done is good enough."

Engineers have for years carried about an oil can and filled individual oil cups.

For years barrels of oil have been rolled into the factory back door to lie about until emptied.

Generations of engineers have held fast to the drop-by-drop method as good oiling practice.

The wastes do not show on the surface. The training and fresh viewpoint of the executive is needed to bring about a complete overhauling of equipment so often necessary — the adoption of radical short-cut methods which promise such big savings.

Using Oil Over and Over Again

The textile plant agent, already referred to, found that after oil was used in his plant it was being thrown away. "It's dirty and not fit to turn back into the bearings," explained the engineer.

So a Filtering System was adopted which made it possible to reclaim 50 to 80 per cent. of this "useless" oil—passing through filter and separator, being thoroughly cleaned and ready for re-use. Here was saving No. 1.

Then the oil was circulated. Instead of the constant watchfulness of the engineer to see that oil cups were kept full from a hand can, oil was piped from storage tank directly to bearing, insuring an automatic and continuous supply of oil to all rubbing surfaces.

And not only was labor cost reduced, but the friction of the engine itself was greatly lessened.

Filters for cleaning oil for reuse can be located in any convenient place. These shown in the Brill works require no attention except cleaning—which is readily done during operation and without trouble or delay.

"Feed an engine all the oil it will take and 5-6 to 9-10 of the friction disappears," say authorities. This way of cutting down friction loss and increasing the life of the engine parts was another big saving which the engineer in the plant had never figured out.

A Complete Efficient System

One oiling system — the Bowser — embraces all these possibilities for oil savings in the power-plant, and more. It has been developed to meet the need for scientific handling and use of oil in any sized plant.

Bowser Storage Tanks make it possible to buy oil at quantity prices, yet store it without fire risk or danger of waste.

Bowser Self-Registering Pipe-Line Measures enable the delivery of oil from the storage point to where you need it in exact quantities by simply turning a valve.

Bowser Circulating Systems collect oil from drip pans, etc., and carry it to separators and filters, where cleaning makes it as good as new.

Our Books Give All the Details

Our books go farther with this story. They show why it pays the executive to make sure of oiling systems. Illustrations of equipment for the American Sheet and Tin Plate Co., the National Cash Register and Curtis Publishing Co., the Westinghouse Electric and Manufacturing Co., etc., illustrate how Bowser Equipment has been applied to their needs. We suggest that you write for these books to-day.

S. F. Bowser & Co.

Inc.

66-68 Frazer Avenue

Toronto Ontario Canada

Made by Canadian workmen and sold by Canadian salesmen.

BRANCHES:

32, Victoria St., S.W. LONDON 5, Rue Denis Poisson PARIS

JOHANNESBURG BUENOS AYRES

MEXICO CITY PORTO RICO HAVANA

Original Patentees and manufacturers of standard, self-measuring, hand and power driven pumps, large and small tanks, gasolene and oil storage and distributing systems, oil filtering and circulating systems, dry cleaner's systems, etc.

Established 1885.

Use Stephenson Bar Belt Dressing

Make 1913 a record breaking year. Turn over a new leaf and get rid of the things that have been causing needless trouble and expense. Adopt the things which will make your work easier, give better results and save money for your employer. You cannot start at a better place than with your belt dressing.

Get rid of your troublesome liquid dressing. Shake the can for the Stephenson solid stick and shake trouble at the same time.

Stephenson Bar Belt Dressing is a friend in need. It doesn't require preparation, nor do you have to use special care in applying it. The minute the belt slips you hold the Stephenson bar to the belt for a few seconds and the slipping stops. There's no waste—no slop—no smearing on of paste or pouring on of spattering liquid. And the results are better.

I'll **"Stick to the Solid Stick"**

Start With a Free ½ Lb. Sample

Simply send us your name and address and we'll send you a present in the shape of a free half-pound sample of Stephenson Bar Belt Dressing.

Remember—we give you this sample absolutely free of charge. Get this free half-pound of the finest belt dressing made and test it. Here's your chance to try somesomething really good at no expense.

None Genuine Without Trade-Mark

Stephenson Manufacturing Company

Est. 1888 **Albany, N.Y.** **Inc. 1897**

The advertiser would like to know where you saw his advertisement—tell him.

THE BELTING
With The Positive Grip

June 30 K 3
& Cuts Malv
Bet W. Walk

D. K. McLaren's Genuine British OAK TANNED Leather Belting

Gives a Service Which Means a Saving of Dollars

That's the ideal combination you are looking for when purchasing **Belting,** and that's the combination secured by **every** purchaser using the above maker's Belting.

It is made from centres of selected hides. **Absolutely** no shoulders, necks or bellies are used.

The **Tanning Process** is the **REAL BRITISH OAK SLOW PROCESS** which is acknowledged to be the best process known.

Every inch of our belting is reliable, while our prices certainly are the **lowest**—quality considered.

Let us get you in touch with some users. Find out what they have to say. Profit by their experience.

The quicker you act the more you will save.

Write now.

D. K. McLAREN, LIMITED

ST. JOHN, N.B.	MONTREAL	TORONTO	VANCOUVER
64 Prince William St.	351 St. James St.	200 King St. West	37 Alexander St.

The advertiser would like to know where you saw his advertisement—tell him.

THE TRIPLEX BLOCK

A Book of the World's Best Practice

WHY shouldn't a workman who handles coal or steel have just as great an output per hour as a man who handles cork? Hundreds of industries are using hoisting machines, and conveying apparatus in connection therewith so efficiently that workmen scarcely realize that the loads they are lifting and moving single handed, thousands of pounds every hour of the day, are more than trifling loads of a few score pounds.

The New Book of Hoists

shows such plants in operation and gives tables of efficiency which will help to solve your manufacturing problems. Send for a copy to-day. To-morrow you may be too busy to think of it.

Triplex Blocks 16 Sizes: One-fourth of a ton to forty tons. 300 Active Stocks all over the United States and Canada.

Every Block Tested to Fifty Per Cent. Overload.

THE CANADIAN - FAIRBANKS - MORSE CO., LIMITED

444 St. James Street **MONTREAL, CANADA**

*The advertiser would like to know **where you saw his advertisement—tell him.***

HOW MUCH WAS MAGNOLIA WORTH?

The difference, as shown hereon, between the price paid for Magnolia Metal and 55c lb. paid for Genuine Babbitt, was in itself, a mere bagatelle compared to the amounts saved in rebabbitting, oil, metal, power, anxiety, etc.

If we had the actual figures, they would probably show that it would have been more economical to have paid as high as Twenty-five ($25.00) Dollars per pound for Magnolia Metal, than to have used Genuine Babbitt, free of cost, and this is, we believe, a conservative estimate.

PARIS LAMP AND MANUFACTURING COMPANY,

2934 Olive Street,
St. Louis, Mo., Feb. 29th, 1912.

Gentlemen:

Have noticed some of your advertisements and letters of recommendation and feel that I should give you an instance of the superiority of MAGNOLIA METAL.

I have been installing and operating electrical and steam machinery for fifteen years—have poured hundreds of journals with various babbitt metals—Had a 60 K.W. Generator running 1,200, the journals of which always gave trouble and finally burned out. We then used a high price babbitt which would not hold—then tried a "Genuine" Babbitt at *55c per pound* with no better results. We then used MAGNOLIA *and it ran the life of the machine.* Also had excellent results with a 125 H.P. Engine that could not be held with any other babbitt.

I believe in credit for whom credit is due and certainly believe it is due Magnolia Metal.

Respectfully,
C. A. Gochenout,
5309 Cabanna Avenue.

SOLD BY LEADING DEALERS EVERYWHERE OR BY

MAGNOLIA METAL CO.

OFFICE AND FACTORY

225 St. Ambroise St., Montreal

SPECIAL OFFER

PRACTICAL ENGINEER POCKET BOOK—7000 pages over 2000 subjects. Price 40c post paid. We import these books in large numbers from England, as an advertising medium, and give Engineers benefit of low price. They are highly spoken of. Address Montreal Office.

6″ Flanged End
Kerr Gate Valve

When next you order an Iron Body Gate Valve, Specify

Kerr's New Pattern

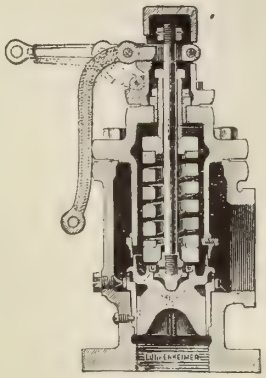
LIKE THIS ILLUSTRATION

We want you to see and try what we know to be the strongest and best made Valve on the market for Standard Pressure. Every Valve tested 300 pounds Hydraulic Pressure.

THE KERR ENGINE CO., Limited

WALKERVILLE, ONTARIO

LUNKENHEIMER POP SAFETY VALVES



Iron Body Brass Mounted, Incased Spring.

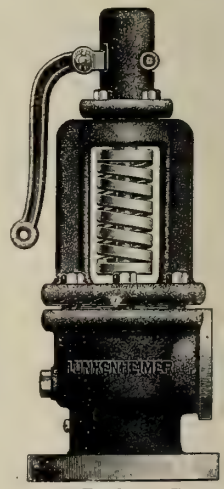
These valves are economical because they will relieve only enough steam to reduce excessive pressures. They can be positively relied upon to operate promptly and will not chatter or pound themselves to pieces.

They can be regulated to reduce the pressure only one pound, if such close regulation should be desired, and adjustment of the pop and pressure can be made from the outside of the valve.

All parts subjected to wear are renewable. Either Brass or Iron Valves can be had, with incased spring or spring exposed.

For durability and reliability, LUNKENHEIMER POP SAFETY VALVES have no equal.

Specify and insist upon securing genuine **Lunkenheimer make.** Do not accept substitutes—they are never as good as the genuine.



Iron Body Brass Mounted, Outside Spring.

"MOST supply houses sell them—yours CAN—if they DONT or WONT tell US."

Write for Catalogue

THE LUNKENHEIMER COMPANY

4-43

Largest Manufacturers of High-Grade Engineering Specialties in the World.
General Offices and Works: CINCINNATI, OHIO, U. S. A.

CHICAGO, 186 N. Dearborn St.
NEW YORK, 64-68 Fulton St.
BOSTON, 138 High St.
LONDON, S.E., 35 Great Dover St.

Try it on the Worst Joint in Your Plant At Our Expense

HOW much time have you wasted following up packing, especially in those hard-to-get-at places? How many times have you had trouble on account of packing blowing, squeezing or burning out? Think what J-M Permanite Packing, with none of these shortcomings, would mean to you.

J-M Permanite is made differently from other packings. It isn't rubber. Yet it possesses the two features which are the only excuse for the existence of rubber packings—resiliency and pliability.

J-M Permanite Sheet Packing

has heat and pressure-resisting qualities because made of the finest grade of long-fibred Asbestos. It will make tight joints under all conditions. It adjusts itself to any joint, and can be used on rough and uneven flanges.

Being one of the lightest packings made, its price, comparatively, is very low, which makes it the most economical packing to use.

All these features make J-M Permanite splendidly adapted for superheated and high pressure service, as well as for low pressures in cylinders and steam chests, and for ammonia lines, acids, alkali and sugar solutions.

We'll send you, without charge, enough of this packing to try in the one place in your plant **where no other packing has ever made good.**

WRITE NEAREST BRANCH TO-DAY FOR SAMPLE AND BOOKLET.

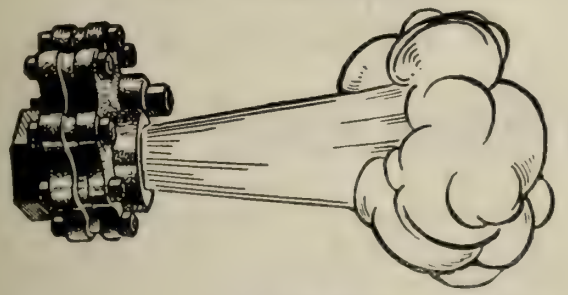
THE CANADIAN H. W. JOHNS-MANVILLE CO., LIMITED

Manufacturers of Asbestos and Magnesia Products — TRADE ASBESTOS MARK — Asbestos Roofings, Packings, Electrical Supplies, Etc.

TORONTO MONTREAL WINNIPEG 1372 VANCOUVER

INVESTIGATION
OF "EVERLASTING" BLOW-OFF VALVES
Will Prove Many Facts

IT NEVER LEAKS!



MADE IN MANY TYPES FOR

Stationary
Locomotive
Marine
Ammonia
Gas and Air

WHY NOT INVESTIGATE?

SOLD AND MANUFACTURED UNDER CANADIAN PATENTS BY

Engineering Specialties Company, 1080 King St., West, TORONTO

AGENTS

MONTREAL, QUE. — H. L. Peiler & Co.
ST. JOHN, N.B. — The A. R. Williams Mach. Co.
WINNIPEG, MAN. — The A. R. Williams Mach. Co.
CALGARY, ALTA. — P. D. McLaren Limited
VANCOUVER, B.C. — Taylor-Forbes Company, Limited

The advertiser would like to know where you saw his advertisement—tell him.

FULTON WATER-COOLED MECHANICAL STOKER

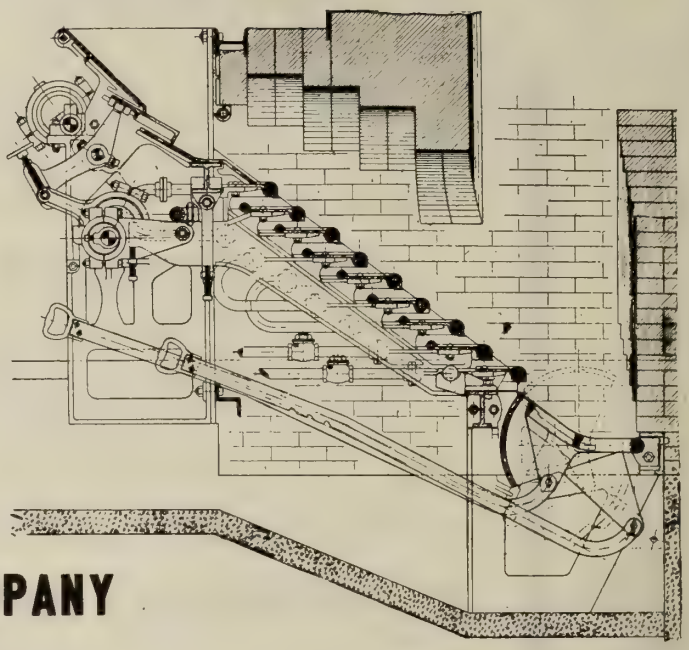
It is Water Cooled.

Repairs Almost Eliminated.

Natural Draft only, but 100% overload easily secured.

Smokeless, in Operation 70-78% Efficiency Obtainable.

Write for Further Particulars.



THE
HARE ENGINEERING COMPANY
Limited

14-16 King Street East **TORONTO, ONT.**

THE VULCAN IMPS

I SAVE LABOR
SO DO I
I CLEAN TUBES EVERY FEW HOURS
I CLEAN TUBES 100%
I LIKE TO PLAY WITH MY COMPETITORS
I BLOW WITH THE DRAFT
I SAVE HOSE

"And We All Save Coal"

Wherever the **VULCAN SOOT CLEANER IMPS** are allowed to work they raise the Devil—the Soot Devil. They juggle the heat units and make two units grow where one unit grew before. They make slow steaming boilers "pop" for the first time in years. They give many a weary engineer and fireman a chance to rest. The IMPS are always on the job, "they work while you sleep." They cut out lost time, trouble and repairs. They are good for the operating man and mighty good for the boiler owner. Don't let Soot, the expense maker, worry you longer. Fill out the coupon, mail it now, and we'll send you our Free Booklet, "Economical Steam Production," which shows how the Vulcan removes Soot, and saves from 5 to 15% in fuel.

Mail the Coupon

Vulcan Tube Cleaning Systems,
LIMITED
42 Craig St. West **MONTREAL**

SIGN, TEAR OUT AND MAIL

P.H. 10-12. Date.....

VULCAN TUBE CLEANING SYSTEMS, LIMITED, Montreal.

Please send me, without charge, your book—ECONOMICAL STEAM PRODUCTION, and your proposition.

(It is important that following information be given in full.)

WATER TUBE BOILERS. Number.....Type.....
Pressure .....Horsepower .....No. Tubes H
(except on Stirling boiler .....Any Superheaters .....Width of alley space at side .....
TUBULAR BOILERS. Number.....Horizontal or Vertical .....
Name .....
Address .....

THERE MUST BE A REASON

FOR REPEAT ORDERS

For Murphy Automatic Smokeless Furnaces

THE HARRIS ABATTOIR CO., Ltd., Toronto, Ont., has had three years' experience with Murphy Furnaces :

1st order	Aug. 1909 . . .	1 furnace, 250 H.P.
2nd "	Oct. 1909	2 furnaces, 500 H.P.
3rd "	Dec. 1912 . . .	3 furnaces, 900 H.P.

This last contract is for equipment for their new abattoir.

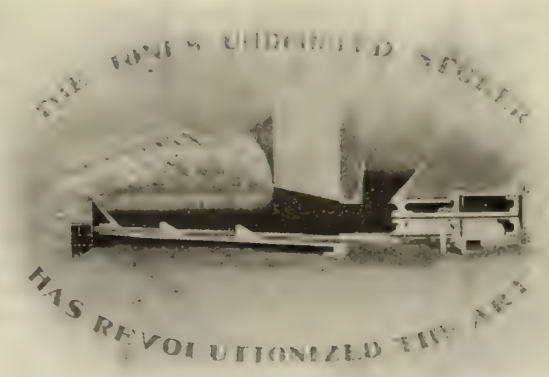
Write to-day for Catalogue

MURPHY IRON WORKS, DETROIT, MICH. BUFFALO, N. Y.

Power Plant Economy Must Begin In The Boiler Room

If the fuel loss is not checked **there**, your engine room results count for little. The little leaks and wastes that get your attention in the engine room are insignificant to the **preventable** waste under your boilers.

The Jones Underfeed Stoker



Is a big paying investment in the small plant. It is a **bigger** paying investment in the bigger plant.

Fuel saving from 10 to 25% interests you. That's what hundreds of Jones Stokers are doing to-day in plants like your own.

Your plant is not an exception. You need a Jones Stoker under every boiler you've got

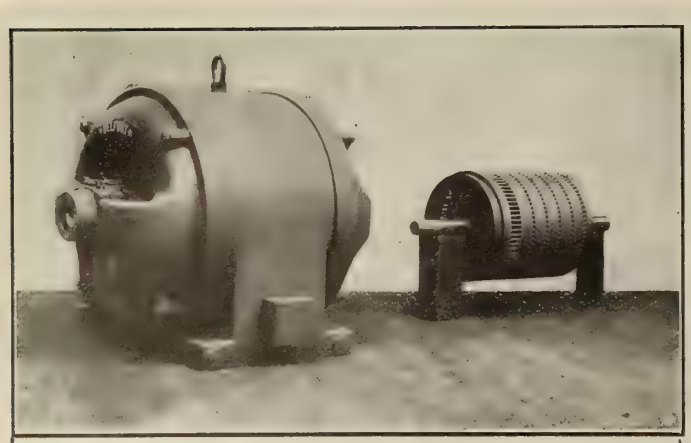
We will redesign your furnace, put in a **Jones Stoker** and **show** you. Write us!

How It Operates

Coal is placed in the hopper and automatically pushed into the green fuel bed under the fire, where it is subjected to a coking effect until it in its turn is forced to the top. Each charge of fuel causes a backward and upward movement that keeps the top of the fire, which is nearest the boiler, constantly agitated without opening fire doors. Air for combustion is admitted between the green fuel and the fire bed. The steam pressure itself automatically controls the fuel and air supply, proportioning them to each other and to varying loads in just the correct amount to obtain the most complete combustion possible from any grade of bituminous coal. As grates form no part of the Jones System, loss of fuel through grate bars is impossible. As combustion is commercially complete and air supply is correct, economy results and incidentally the smoke nuisance is effectively eliminated.

Jones Underfeed Stoker Co., Limited

National Trust Building :: TORONTO



HIGHSPEED INDUCTION MOTOR

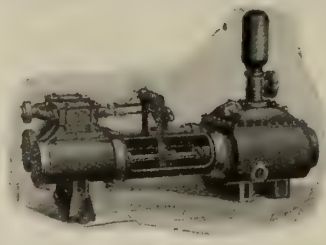
POWER PLANTS, ROLLING MILLS, MINING, HOISTING MACHINERY

ELEVATORS PATENT "STIGLER"

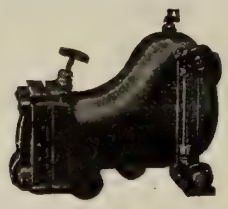
Builders under patents of **"STE. ALSACIENNE'**
Belfort (France) Mulhouse, Grafenstaden (Germany)

Engineering Works of Canada
MONTREAL, Quebec

STEAM and POWER PUMPS, CONDENSERS, TRAVELLING CRANES



The SMART-TURNER MACHINE CO., Limited
Hamilton Canada

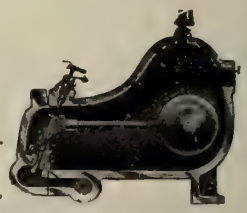


McDANIEL IMPROVED STEAM TRAP

FOR HIGH OR LOW PRESSURE.
Steam can't blow through. They have large discharge valves and cannot be flooded from sudden flushes of water.

MAY WE SEND ONE FOR TRIAL?

Reducing Valves, Pump Governors, Relief Valves, Exhaust Pipe Heads, Ejectors and Steam Separators. SEND FOR CATALOGUE.



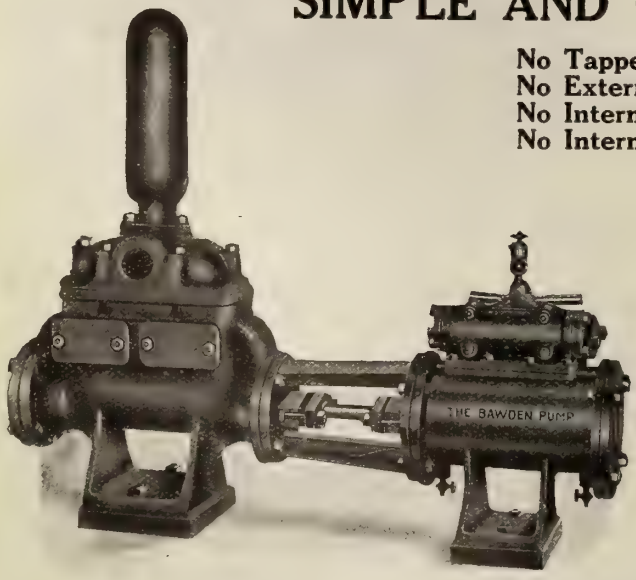
THE GARTH COMPANY
26 Craig St. MONTREAL, CAN.
WATSON & McDANIEL CO.,
No. 146 N. 7th St. PHILADELPHIA, Pa.

"BAWDEN" STEAM PUMPS

MANUFACTURED UNDER ATTWOOD'S PATENTS

SIMPLE AND COMPOUND, For all Purposes

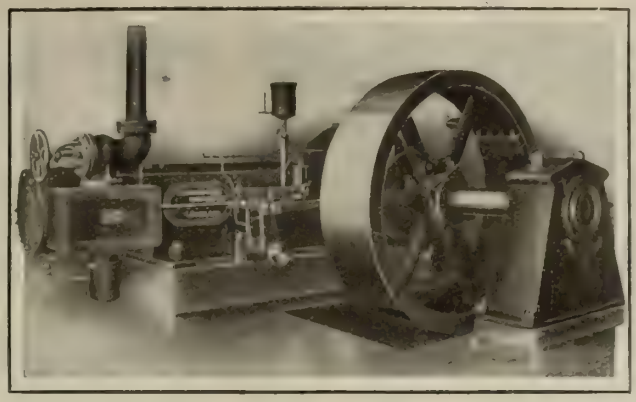
No Tappets.
No External Valve Gear, Levers or Springs.
No Internal Tubes.
No Internal Stuffing Glands.



"Bawden" Pumps are governed by piston valves which are controlled by the action of live steam only.
—Simplicity throughout.
—Guaranteed to make full stroke under constant or varying loads.
—Valves, latest improved steam balanced type.
—Greatest economy of steam consumption.
The Bawden Pump provides the simplest, most economical and reliable means for feeding high or low pressure boilers.
Flexibility of speed obtained without any mechanical adjustment.
Automatic cushioning of piston and valves ensures greatest safety in any emergency.

THE BAWDEN MACHINE CO., Ltd., Toronto, Can.

The advertiser would like to know where you saw his advertisement—tell him.



Side Crank Leonard Automatic Engines

Particularly adapted for Direct Dynamo Connection and Electric Light Service. Made in Simple and Compound Units up to 500 Horse Power. For High Economy and Close Regulation this engine is unexcelled.

We also make High and Slow Speed Corliss Engines for Heavy Duty Service. Our "Tangye" Engine is very well and favorably known throughout Canada for Sawmill Work.

MADE BY

E. LEONARD & SONS, LONDON, ONTARIO

MANUFACTURERS OF

High and Slow Speed Engines of all kinds, Boilers, Heaters, Pumps, etc., etc., and complete Steam Plants.

WAREHOUSES AND AGENCIES AT

MONTREAL, ST. JOHN, N. B., CALGARY, WINNIPEG, VANCOUVER

Marsh Steam Pump

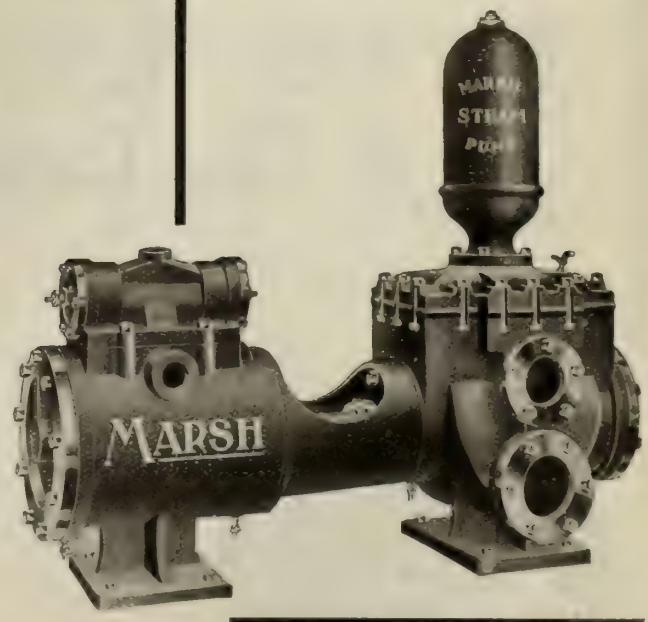
The Pump with the Self-governing Steam Valve

Note the extreme simplicity in construction and the absence of outside valve motion. There is practically nothing to get out of order. Nearly all the wearing parts are made of phosphor bronze instead of common brass, including piston rod, water cylinder lining and valve seats.

The steam valve is self-governing and admits only just enough steam to do the required work. The pump cannot short-stroke, race or pound under the most severe conditions.

115,000 in successful operation.

Ask for Catalog No. 18

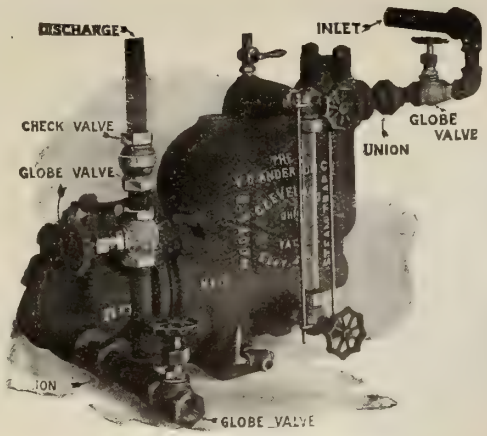


American Steam Pump Company

BATTLE CREEK - - - MICH.

CANADIAN AGENTS

A. R. Williams Machinery Co., Toronto
Williams & Wilson, Montreal
London Engines Supplies Co., London, Ont.
Stuart Machinery Co., Winnipeg
Hallman Machinery Co , Vancouver, B. C.
Mechanics' Supply Co., Quebec, Que.
Gorman, Clancey & Grindley, Limited
Edmonton & Calgary



The above illustration shows the correct way of piping up the Model "D" Trap, when the condensation is delivered above the level of the trap.

The Anderson Model "D" Steam Trap

Is a Steady And Continuous Drainer, And Automatically Adjusts Itself To Any Varying Amounts Of Condensation Within Its Capacity

All parts are interchangeable, being machined to solid gauges, thus ensuring absolute accuracy.

The trap is so constructed that **you can change the valve and seat from high to low pressure or vice versa in five minutes** without disturbing or unscrewing a single steam joint or pipe connection.

A removable strainer is part of the equipment. It prevents pieces of scale, packing, etc., from entering the trap.

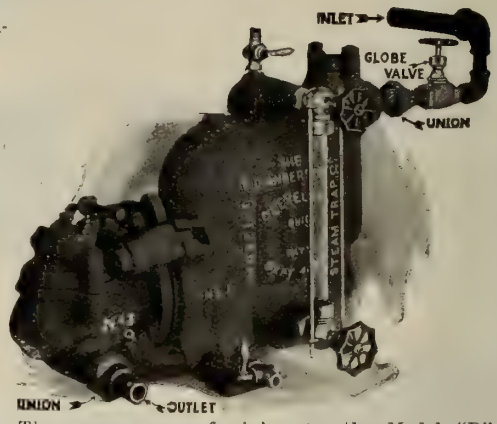
Every "Anderson" Model "D" Steam Trap is fully guaranteed to give satisfactory service.

Drop us a card to-day for descriptive booklet.

THE V. D. ANDERSON CO.

1935 West 96th St., CLEVELAND, OHIO

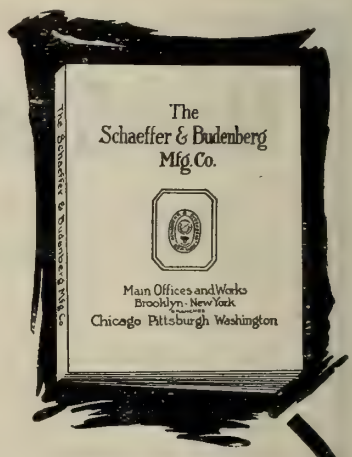
BRANCH OFFICES: 330 Manhattan Building, Chicago, Ill.; 619 Park Bldg., Pittsburg, Pa.; 3 Arch St., Philadelphia, Pa.; 212 Walnut St., Cincinnati, Ohio; 207 Union Trust Building, Baltimore, Md.; 91 High Street, Boston, Mass.



The proper way of piping up the Model "D" Steam Trap for all ordinary purposes where the condensation is discharged on a level with or below the outlet of the trap.

You *Must* Have a Copy of This Catalog

For it is extremely interesting, Mr. Engineer, and is just chuck full of valuable information.



It tells how you can quickly raise the efficiency of your boilers, and cut coal bills—meaning a "raise" for *you.*

It tells all about the "Columbia," the "Gem of Recording Gauges"—how it will help you "make good."

And last but not least, it tells why the "Columbia" is the most popular of Recording Gauges—why thousands are in daily use.

Your copy of this catalog is ready for you. Send for it now—a postal will do.

Just Say : Send Catalog W-100

The Schaeffer & Budenberg Mfg. Co.

Chicago BROOKLYN, N.Y. Pittsburgh

(114)

The advertiser would like to know where you saw his advertisement—tell him.

The Stoker for Pulp and Paper Mills where cheap steam without smoke or grits is essential.

Bennis New Link Chain Grate Stokers

Bennis High Temperature Coking Stokers

AND

Patent Self-cleaning Compressed Air Furnaces

FOR

Water Tube and Horizontal Return Tube Boilers

Bennis Machines are **saving** millions of dollars a year.
Bennis Machines are supplying over 3¼ millions of Horse Power.

Bennis Machines are hourly demonstrating in actual practice what CHEAP STEAM really means. They show what can be done with poor-grade, low-price fuels when efficiently burnt. They are designed and constructed to save boiler life; to keep down the coal bill; to abolish smoke, and to ensure maximum results from each pound of coal.

Bennis Stokers are constructed with the greatest care and fitted to meet individual conditions. They are SPECIALLY DESIGNED for the various types of boilers.

The coal is automatically carried from the store to the furnace when the Bennis Machine Stokers are fed by means of Bennis elevators and conveyors. Bennis Coal and Ash-handling Plant has acknowledged advantages over other types. One marked advantage is the small amount of power required to operate it effectually.

Write for *"Common Sense Machine Stoking"* pamphlets and full particulars to:

G. H. TOD, 213 Manning Chambers Queen Street West **TORONTO**

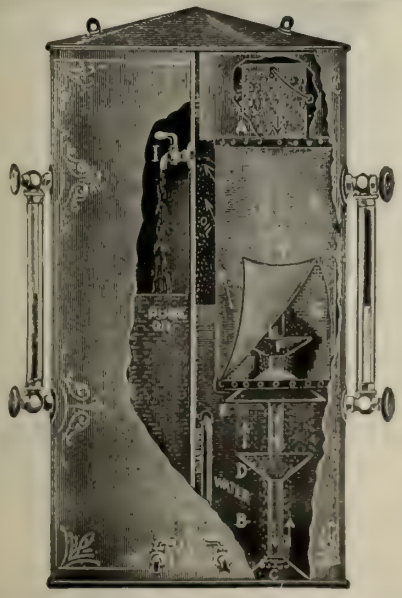
A central station in the Midlands, England, where Bennis plant has established record economies.

Don't Let Your Oil Go to Waste—You Can Use it Over Again At a

Saving of 65 per cent.

Or More By Passing It Through

THE "SIMS" OIL FILTER



The quality of Oil is not impaired by its use—it simply cannot be used again on account of foreign matter it has taken up passing through the bearings.

The "SIMS" Oil Filter removes these impurities.

This Filter is made of the best grade of galvanized sheet iron, double-lapped joints, riveted, well braced and soldered. It has a partition through the centre, which separates the clean Oil section from that used for filtration. The clean Oil is not disturbed when the filtering section is being cleaned; for continuous oiling systems this arrangement is very effective.

Let us tell you more about this OIL SAVER AND PURIFIER.

You cannot afford to be without it any longer. Write to-day.

THE SIMS COMPANY, Erie, Pa.

CANADIAN REPRESENTATIVES:

H. L. Peiler & Co., 380 St. James St., Montreal, Que., and 84 Church St., Toronto, Ont.

Valuable Boiler Information

FACTS BASED ON WORLD WIDE EXPERIENCE WITH WATER TREATMENTS AND SCALE DISSOLVENTS.

¶ A 100 H.P. Boiler evaporates 30,000 pounds in ten hours or 390 tons per month.

¶ In comparatively pure water there would be at least 88 pounds solid matter, and even in many kinds of spring water as much as 2,000 pounds.

¶ The presence of scale or sediment means burning and cracking of boilers, predisposition to explosions and loss of fuel in the following proportions: 1/16 inch, 13%; 1/4 inch, 38% and 1/2 inch 60%, saying nothing about repairs and loss of use of boilers.

¶ Compounds containing organic matter help rather than hinder incrustation.

¶ Compounds composed of bark and wood contain tannic acid which injures the metal.

¶ Molasses, fruits, etc., contain acetic acid, which is more injurious than tannic.

¶ Soda ash and alkalis dissolve scale, but also injure the metal, besides causing foaming if used excessively.

¶ Petroleum has been tried in certain waters, but crude oil helps to form scale, therefore the refined only is of any use.

¶ Tannate of soda has been partially successful in waters which do not contain sulphate.

¶ None of the above are effective where marshy or muddy water is used.

¶ These investigations have proved that the only right principle is a metal treatment, not a water treatment or scale dissolvent.

PEROLIN IS THE ONLY METAL TREATMENT

Let us prove its merits at our expense.

Dominion Specialties,
LIMITED

44 Adelaide St. West **TORONTO**

PRICHARD'S BABBITTS
ARE
SOLD ON MERIT

They are designed to meet modern machinery conditions.

They are all COPPER-TIN-TOUGHENED, are DROSS FREE, and are made from the purest Metals obtainable.
WE want you to know the following of our Brands:

PRICHARD'S EAGLE GENUINE
PRICHARD'S MACHINERY SPECIAL
PRICHARD'S METALLIC PACKING
PRICHARD'S MAPLE LEAF

They represent the best that can be made, for **High Speed, Heavy Pressure,** or **General Purpose** use. We make Babbitt Metal ONLY—and we make it specially for any place in which it can properly be used.
Our PRICES ARE ROCK BOTTOM, and are named F.O.B. your nearest RAILWAY STATION. Descriptive Catalogue and Prices on request.

MANUFACTURED BY
The DOMINION METAL COMPANY
N. B. PRICHARD, Prop.
SHERBROOKE, P. Q.

Montreal Selling Agents
Foss & Hill Machinery Co., 344 St. James Street, Montreal

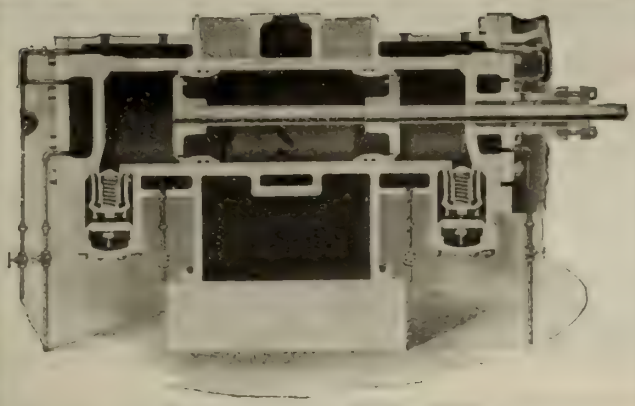
GRAPHITOL
Pat. and Trade Mark Reg'd.

The graphite cement bearing material.
Another step in the ladder of progress.
A distinct advance over babbitt metals.
The most frictionless material yet produced.
A thorough success.

Write for free illustrated pamphlet describing this material, to

British Pacific Supply Company
F. C. Winkler, Manager,
VICTORIA, B. C.

MAKERS OF GRAPHITOL.



Section Through Arctic Compressor

Raw Water Ice On The Arctic - Pownall System

is the practical, positive method to reduce your ice-making cost.

The Arctic is the only ice machine on earth whose suction valve is absolutely without spring, bolt or nut to work loose. And our raw water freezing system is as simple and dependable as our compressor itself.

Get Arctic bulletins and proposition on your needs—no obligation involved.

"We Do It Right."

The Arctic Ice Machine Company

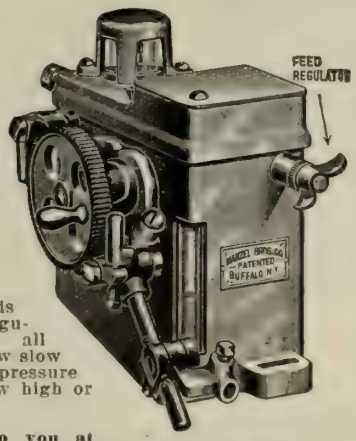
Canton, Ohio, U.S.A.

MANZEL

AUTOMATIC FORCE AND SIGHT FEED OIL PUMP

Saves 50 per cent. in oil, over that of any Hydrostatic Lubricator.

Try it and see for yourself — At our expense



We will send this Oil Pump to you on a 30 Days' Trial.

If at the end of that period it does not prove exactly as we claim, send it back back to us.

With this Pump Oil is fed into the Cylinder regularly, and positively all the time—no matter how slow the engine runs, what pressure of steam is carried, how high or low the temperature.

Ask us to send it to you at once.

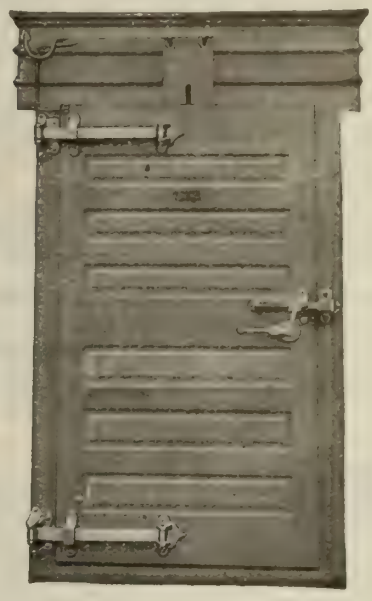
THE TWIN CITY OIL COMPANY

General Agents for Canada

BERLIN - ONTARIO

MANZEL BROTHERS COMPANY, BUFFALO, N.Y.

J. V. Jamison, President. T. B. South, Vice-President. J. V. Jamison, Jr., Treasurer.



This "Ad" is addressed to users of

Refrigerator Doors, Windows and Ice Chutes in Canada

for Cold Storage, Meat, Fish, Dairy, Poultry, Fruit and Vegetable products.

We guarantee our Doors not to sag or stick in the frames.

Our Hardware weighs 60 lbs. to set.

We manufacture or sell nothing else.

Our entire time and forces are directed to this line.

We supply

Linde British Refrigeration Co.
Linde Canadian Refrigeration Co. of Canada.
Armour & Co., Chicago, Ill., U.S.
Swift & Co., Chicago, Ill., U.S.

with all they use. Our latest orders are to Swift & Co., for Toronto, Can., 30 Doors; Canadian Fish and Cold Storage Co., Prince Rupert, B.C., 110 Doors.

Send for Catalogue

Jones Cold Store Door Co.

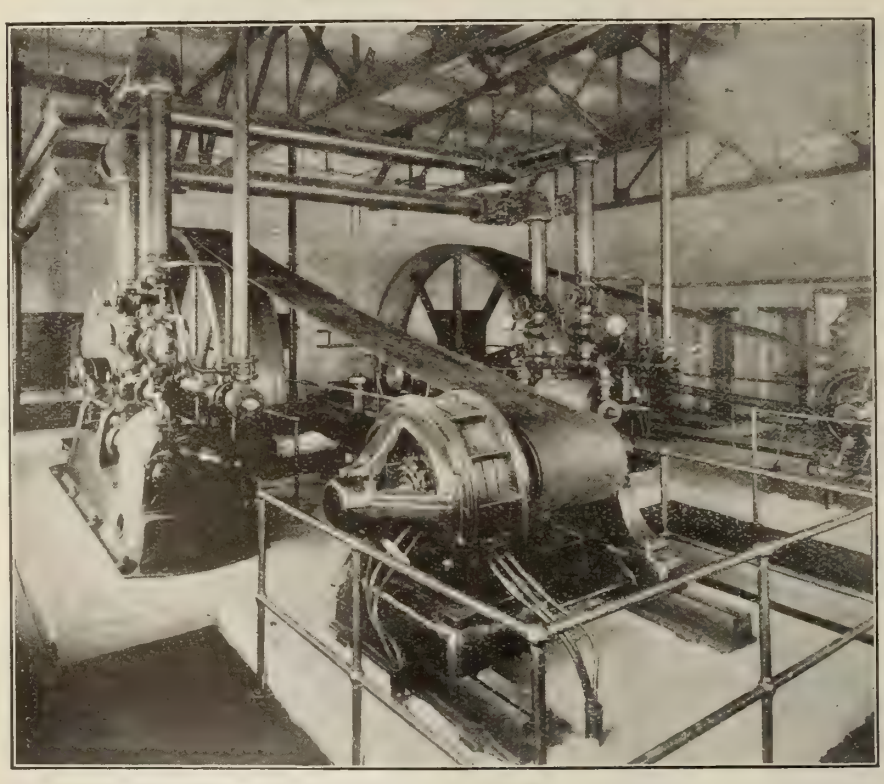
HAGERSTOWN, MARYLAND, U.S.A.

"THE LINDE"

REFRIGERATING and ICE-MAKING MACHINERY

CORK INSULATION

Over 8,000 Machines in use. Established and Manufacturing in Canada for 16 years.



Two 100-ton "Linde" Belt Drivers, Double Acting, Horizontal Ammonia Compressors Manufactured and Installed by us in Canada.

Recent Orders:—

IMPERIAL BREWING CO., (3 orders), Kamloops, B.C.
WM. CLARK, LTD., Montreal, Que.
MR. J. A. PATRICK, New Westminster, B.C.
C.P.R. VANCOUVER HOTEL, Vancouver, B.C.
MATTHEWS-LAING, LTD., Fort William, Ont.
CARSON'S HYGIENIC DAIRY CO., Winnipeg, Man.
ST. THOMAS PACKING CO., St. Thomas, Ont.
MONTREAL GENERAL HOSPITAL, Montreal, P.Q.
OTTAWA UNIVERSITY, Ottawa, Ont.
WM. DAVIES CO., Winnipeg, Man.
CANADIAN NATIONAL EXHIBITION, Toronto, Ont.
McGILL UNIVERSITY, Montreal, P.Q.
G.T.P. FORT GARRY HOTEL, Winnipeg, Man.
C.P.R. ALGONQUIN HOTEL, St. Andrews, N.B.
AND MANY OTHERS.

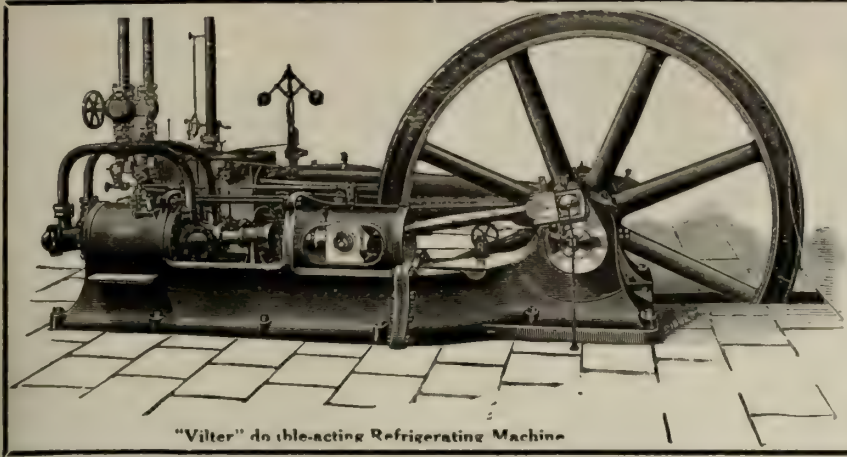
The Linde Canadian Refrigeration Co.,

Limited

37 ST. PETER STREET, MONTREAL

Branch Offices—Toronto, Imperial Building, Adelaide St.; Winnipeg, 909½ Main Street; Vancouver, Anderson & Miskin, Imperial Block, Seymour and Pender Streets; Edmonton, Walker & Barnes, 562 Second Street; Calgary, General Supplies Limited, 1233 2nd Street East.

The advertiser would like to know where you saw his advertisement—tell him.



"Vilter" double-acting Refrigerating Machine

Established 1867

The VILTER MFG. CO.

242 Becher St. Milwaukee, Wis.

BUILDERS OF HIGH-GRADE

CORLISS ENGINES
ICE AND REFRIGERATING MACHINERY

any size and for any purpose, complete line Ammonia Fittings, Condensers, Brine Coolers, etc.

Write for Catalogue and full Particulars

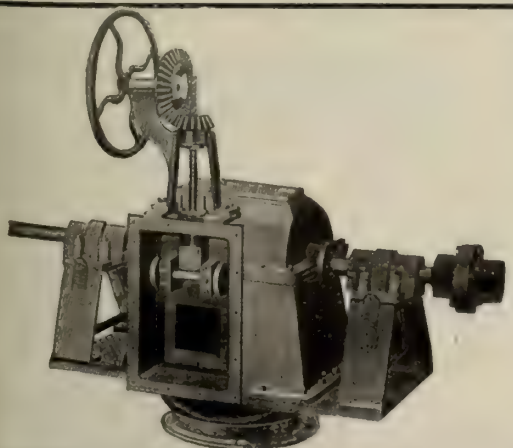
The
LINDE BRITISH
Refrigeration Co. Limited

¶ Numerous fully authenticated laboratory tests organized from time to time in America and Europe, have invariably served to demonstrate in an unanswerable manner, the very remarkable degree of mechanical efficiency to which our products have been brought. *The history of mechanical refrigeration is our history.*

Head Office: LONDON, ENG.

BIRMINGHAM	GLASGOW	JOHANNESBURG, S.A.
BRISTOL	BOMBAY	SYDNEY, N.S.W.
LIVERPOOL	CALCUTTA	PORT NAPIER, N.Z.

CANADIAN OFFICES
CORISTINE BLDG
MONTREAL



Little Giant Water Turbine

Self-contained Unit

Mounted on vertical or horizontal shafts. Gate consists of single casting, and is trouble proof. Adapted for all heads. Highest efficiency guaranteed.

Write for Catalog. Prices will Interest You.

J. C. WILSON & CO.

Founders and Machinists. GLENORA, ONT.

The advertiser would like to know where you saw his advertisement—tell him.

ADANAC RED CORE RUBBER COVERED WIRES AND CABLES

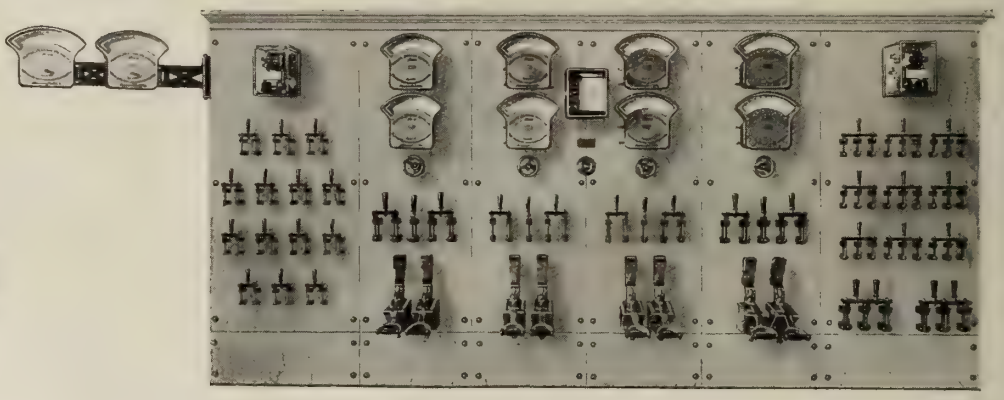
Are made according to the specifications of the National Board of Fire Underwriters. The conductors are drawn from copper of the highest conductivity and are covered with two thicknesses of thoroughly vulcanized rubber compound of high quality. The wires are braided over insulation and the smooth high finish they receive makes them specially desirable for conduit work.

IMPERIAL WIRE AND CABLE COMPANY
Limited
MONTREAL

THE Northern-Electric AND MANUFACTURING CO. LIMITED
Sales Agents

TORONTO REGINA WINNIPEG
CALGARY EDMONTON VANCOUVER

What's The Result?



We made this Switchboard for Bank of Toronto, Toronto, Ont.

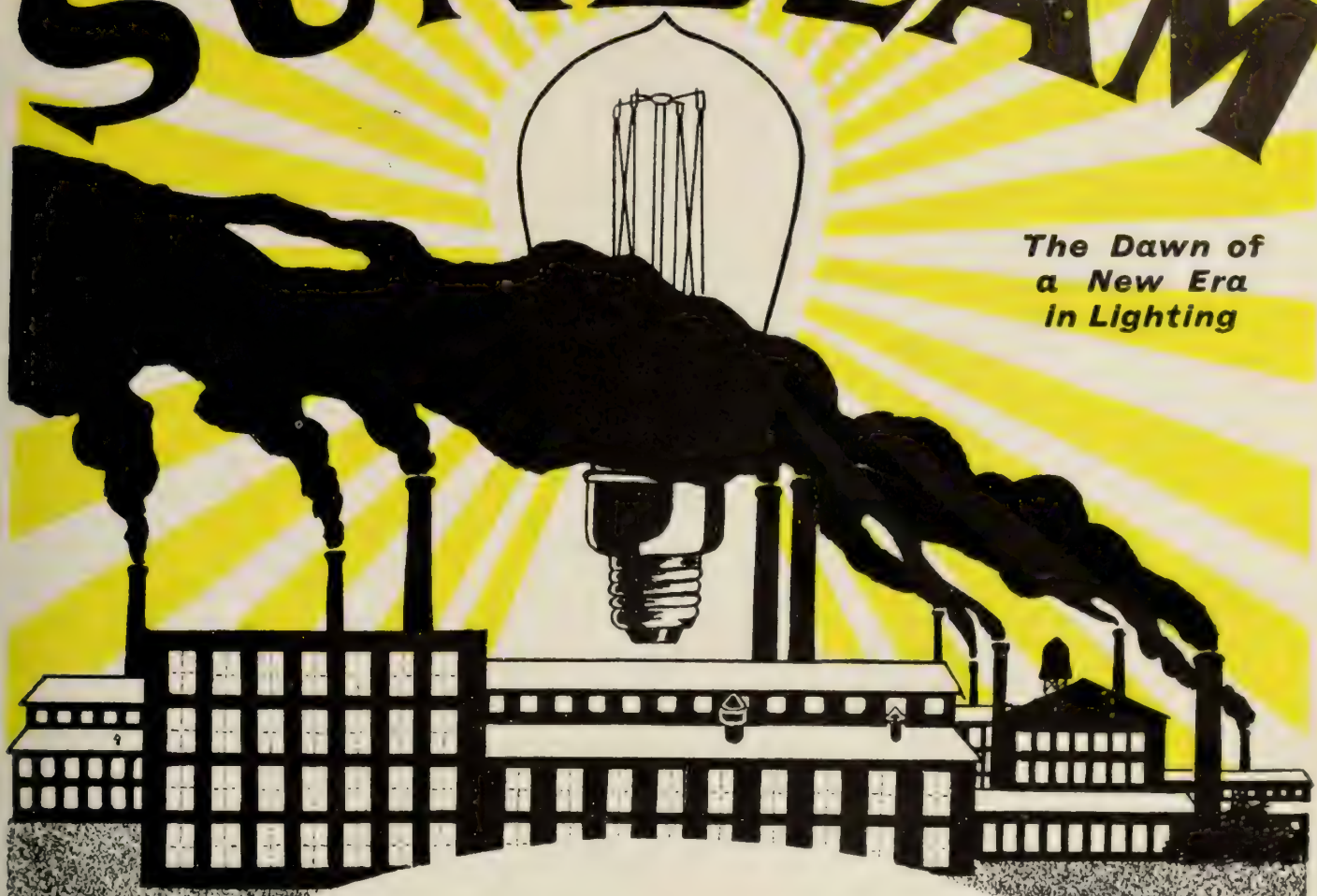
When your switchboard is designed by men of unquestioned ability having years of practical experience. ¶ When the wokmanship equals if not surpasses the highest attainments in switchboard construction. ¶ When the instruments used are the standard and bear the highest reputation in the world for quality and dependability. ¶ THE RESULT—the acme of good service at all times and under all conditions.

THE Northern-Electric AND MANUFACTURING CO. LIMITED

Manufacturer of Telephone and Firm Alarm Apparatus and Distributor of Electrical Supplies for every possible need.

Montreal Halifax Toronto Winnipeg Regina Calgary Edmonton Vancouver

SUNBEAM



The Dawn of a New Era in Lighting

The "SUNBEAM" Drawn Wire

"MAZDA" LAMP

Gives a Light That Means Greater Production

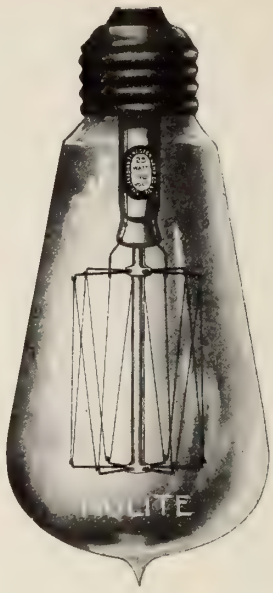
Gives Three Times as Much Light as the Carbon Lamp at Same Current Consumption

The Label on each lamp is a guarantee of quality and service. Send us a trial order.
You will get double the light and a greatly reduced lighting bill.
We ship quickly.

The Canadian Sunbeam Lamp Co., Ltd.

Main Office and Factory : Dufferin and Liberty St., TORONTO

North-Western Office and Warehouse :
137 McDermott Ave.,
WINNIPEG



"NULITE"

Drawn Wire Continuous Filament

TUNGSTEN LAMP

(You have tried the rest, now try the best) and understand what a real good tungsten lamp is.

We have embodied in the "Nulite" lamp the drawn wire short filament principle which allows this particular lamp to adapt itself to maximum vibration in any position, thereby assuring you of non-breakage and the inconvenience of being suddenly left in the dark.

After many exhaustive and expensive tests our Experts have without doubt produced the best lamp on the market, and it is our intention to keep the quality up.

A trial will convince you of the superiority of the "Nulite" Lamp.

MANUFACTURED BY

THE CANADIAN TUNGSTEN LAMP CO., Ltd.

HAMILTON, ONT.

BRANCHES AT

Montreal, 246 Craig St. W.
Winnipeg, 56 Albert St.
Vancouver, 365 Water St.

AGENCIES:

T. McAvity & Sons, St. John, N.B.
Farquhar Bros., Halifax, N.S.
Mechanics Supply Co., Quebec, Que.
Dominion Illuminating Rental Co., Toronto, Ont.

The advertiser would like to know where you saw his advertisement—tell him.

SUNBEAM

The Dawn of a New Era In Lighting

The "SUNBEAM" Drawn Wire
"MAZDA" LAMP

Gives a Light That Means Greater Production

Gives Three Times as Much Light as the Carbon Lamp at Same Current Consumption

The Label on each lamp is a guarantee of quality and service. Send us a trial order.
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Main Office and Factory : Dufferin and Liberty St., TORONTO

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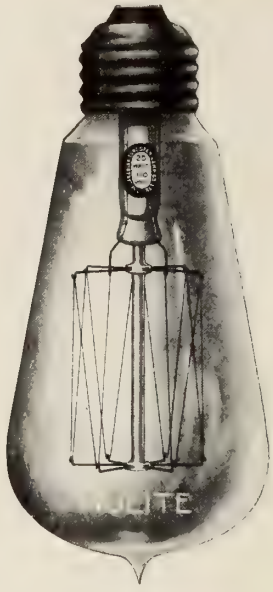
137 McDermott Ave.,
WINNIPEG



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T. McAvity & Sons, St. John, N.B.
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NEWTYPE BERGMANN LAMPS

(Tungsten Filament)

THE UNBREAKABLE KIND

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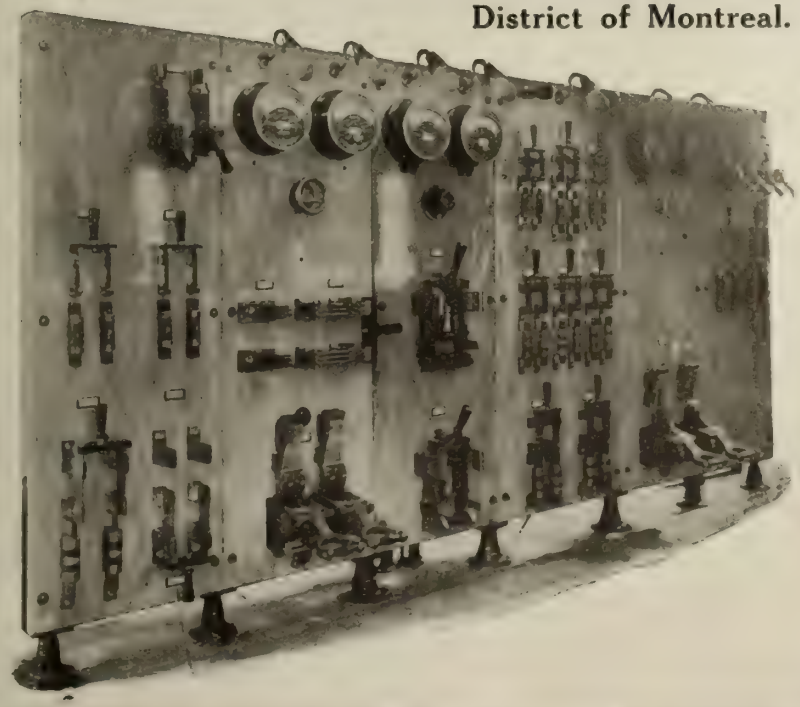

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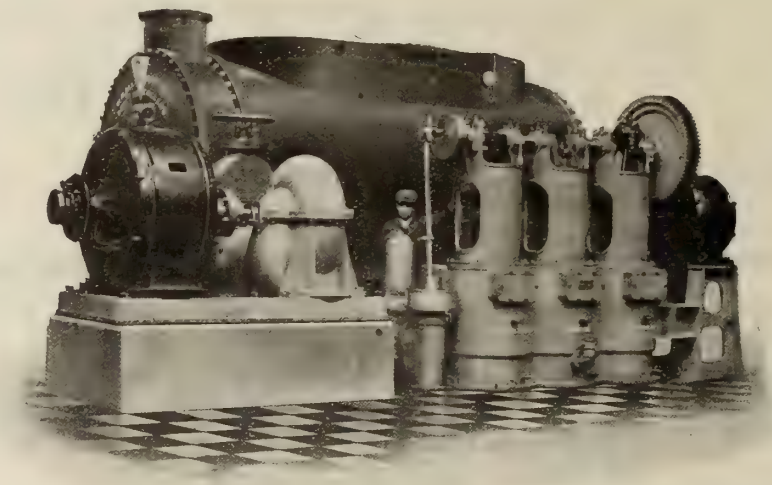
QUEEN'S ENGINEERING WORKS, BEDFORD, England

"CONQUEROR"

CONDENSING MACHINERY

HIGH EFFICIENCY HIGH VACUUM



66 thousand lbs. of steam per hour, 28 inch Vacuum. Centrifugal Circulating Pump driven direct by Motor, a separate Motor driving through gearing an "Allen Edwards" Three-Throw Air Pump and Condensed Water Lifting Pump.

Small quantity of circulating water.

Lower power required for driving pumps.

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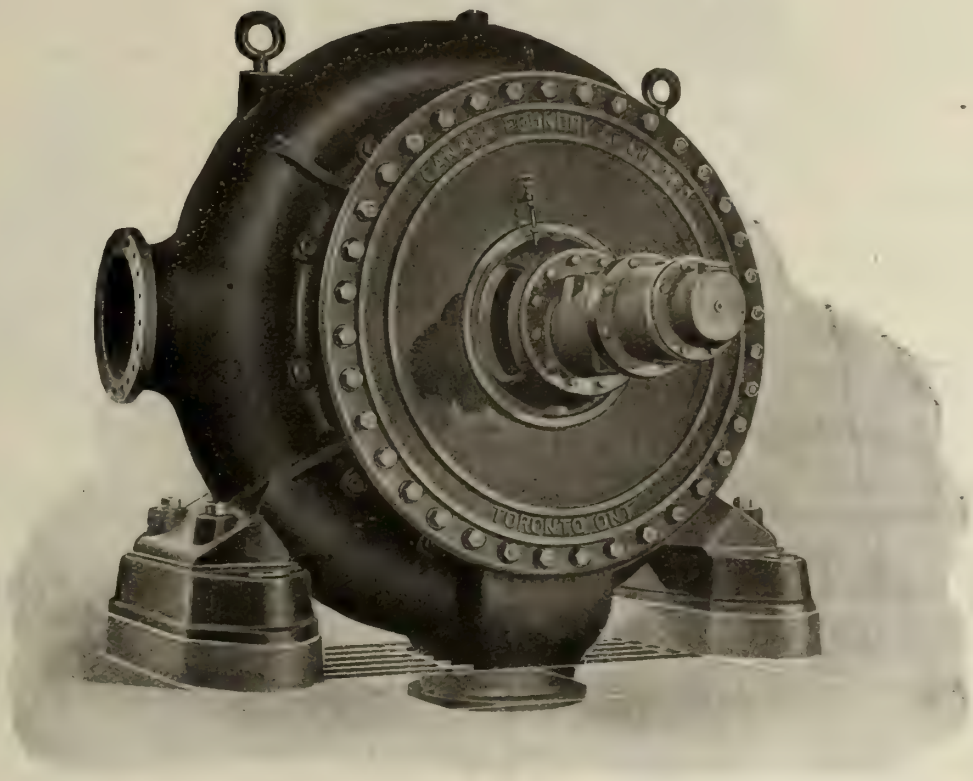
Mather & Platt, Limited

PATENT TURBINE PUMPS

For All Duties



24″ Single Stage Turbine Pump

Sole Licencees for the Manufacture in Canada
of the "Original Turbine Pump"

Canada Foundry Company, Limited

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CONDENSER PLANTS
OF THE
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Types
SURFACE
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We have installed this type of plant in the municipal plants of:—

Edmonton,
Lethbridge,
North Battleford,
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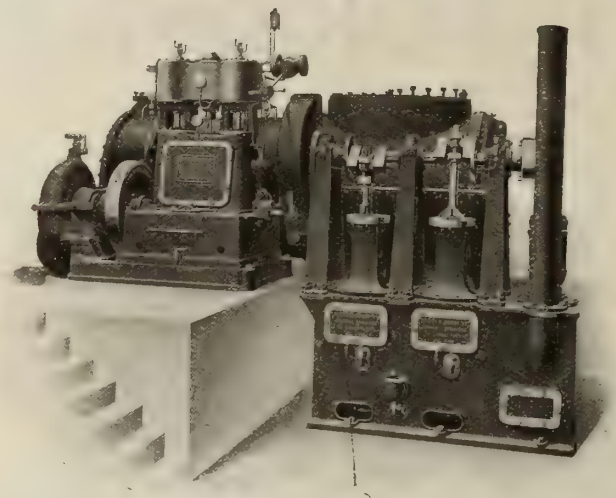

Surface Condenser with Air and Centrifugal Pumps, direct connected to a Belliss & Morcom Compound Engine.

Increase the power from your existing **engines.**

Improve steam **consumption.**

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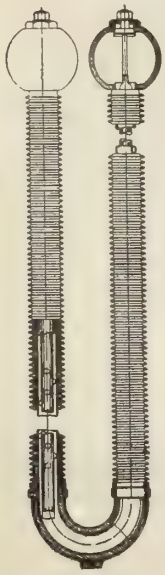
"FOSTER" SUPERHEATERS



SUPERHEATER TUBES

If your boilers are not designed for high pressure, or if your boilers have been weakened by use—

Let us fit them up with "Foster" Superheaters in this way, **rendering the boilers serviceable at a moderate cost,** and **without the waste of time and inconvenience** incident to renewal

Write to us for Catalogue on Superheated Steam.

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"PATERSON" OIL ELIMINATOR

With
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fitted when required.

Install one of our Oil Eliminators and **do away with the waste** in heating and engine drip returns **now running to the sewer.**

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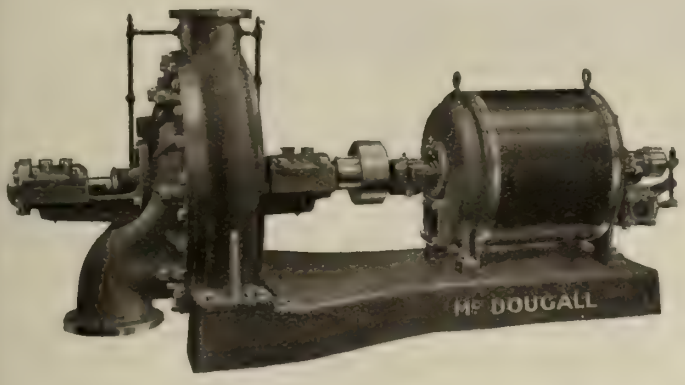
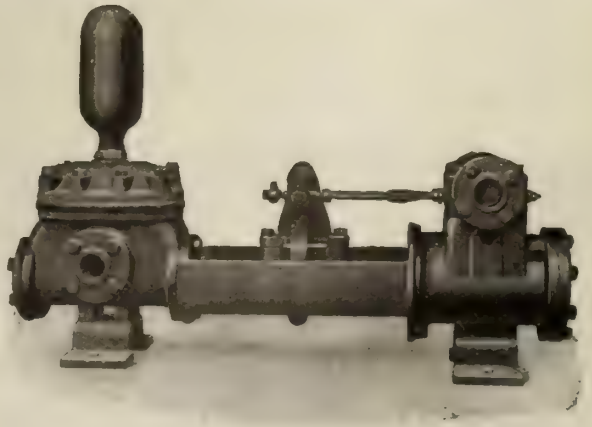
Pumping Machinery

Centrifugal or Reciprocating



Worthington Turbine Pump driven by Steam Turbine, capacity 1,000 Imp. Gals. per min. against a head of 150 ft. For other applications of turbine pumps see Bulletin 108.

Blake Simplex Steam Pump, built for 250 lbs. per square inch, working steam and water pressure, but sold at same price as so called "trade" pumps. See Bulletin 875.



THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., Limited

Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

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ESTABLISHED 1870.

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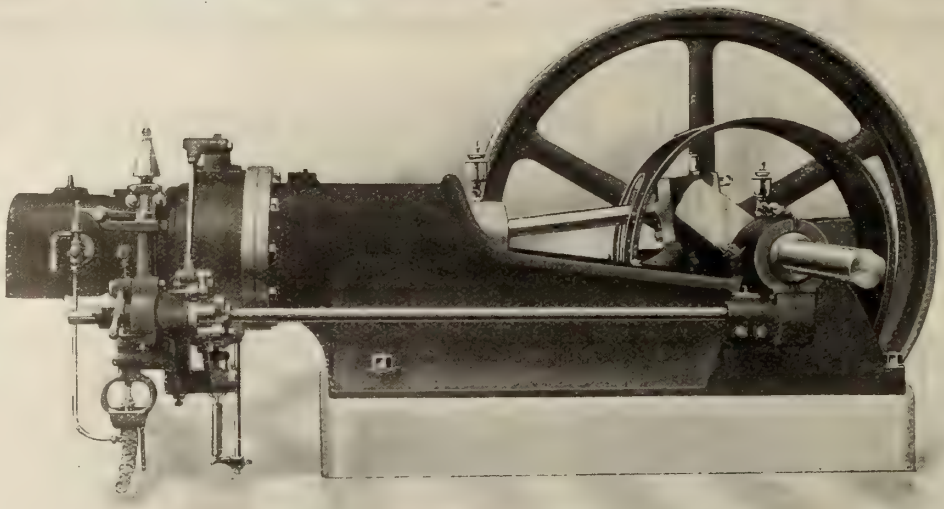
Sole Makers of the "Robson" Oil Engine for working on Crude and Petroleum Oils.



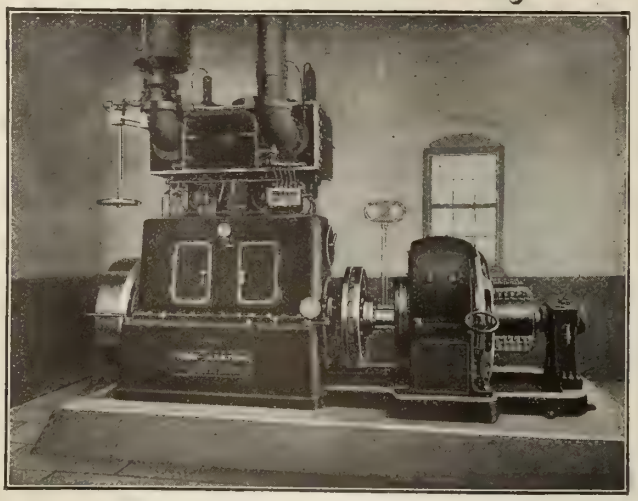
Sole Makers of the "Robson" Engine for working on Towns and Suction Gas.

"Photograph of Oil Engines, (new design) 3½ to 20 B. H. P."

Suction Gas Producer Plants for working on Anthracite Coal, Coke or Charcoal.

AGENTS WANTED. **WRITE FOR CATALOGUE.**

When you buy a high-priced engine, you have a right to expect a design that represents the latest and best in engine practice, a construction of the finest workmanship, a machine incorporating the best materials ; in short a



ROBB VERTICAL ENGINE

These engines are peculiarly well adapted to power plant work, whether for main engine driving generators, or for auxiliaries driving turbine pumps, fans, etc. The speed is right—they're entirely enclosed—automatically lubricated — accessible — perfectly balanced.

Fully described in Bulletin No. 201.

INTERNATIONAL ENGINEERING WORKS, LIMITED

Manufacturers of
ROBB ENGINES AND BOILERS

So. Framingham, Mass. **Amherst, N.S., Can.**

SOLE CANADIAN AGENTS FOR
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Turbines, Turbo-Electric Generators, Turbo-Pumps, Blowers and Compressors 39-44

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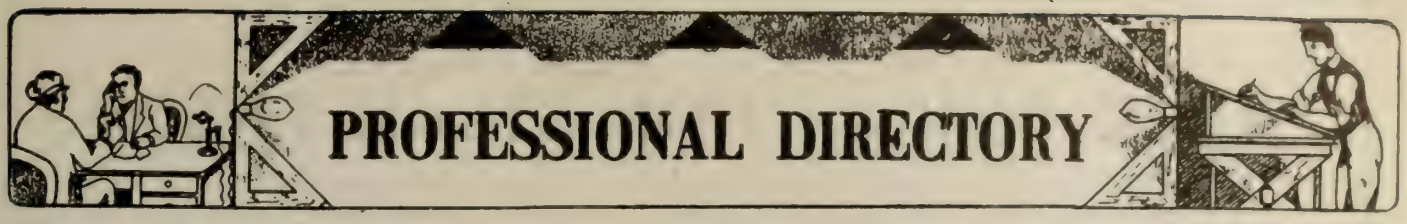

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Indicating, valve-setting and general repairs on all kinds of engines.
RENOWN ENGINE & MACHINE CO.
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Miners and Exporters of
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Write us for your requirements in MICA

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obtained in all Countries.
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MONTREAL CANADA

Bare and Insulated Electric Wire
Electric Light Line Wire. Incandescent or Flexible Cords.

Railway Feeder and Trolley Wire
Americanite, Magnite, Office and Annunciator Wire. Cables for Aerial and Underground Use.

HALIFAX TORONTO WINNIPEG VANCOUVER

The advertiser would like to know where you saw his advertisement—tell him.

G. & McC. VERTICAL QUICK REVOLUTION STEAM ENGINES

Will give you as they are giving others wherever installed

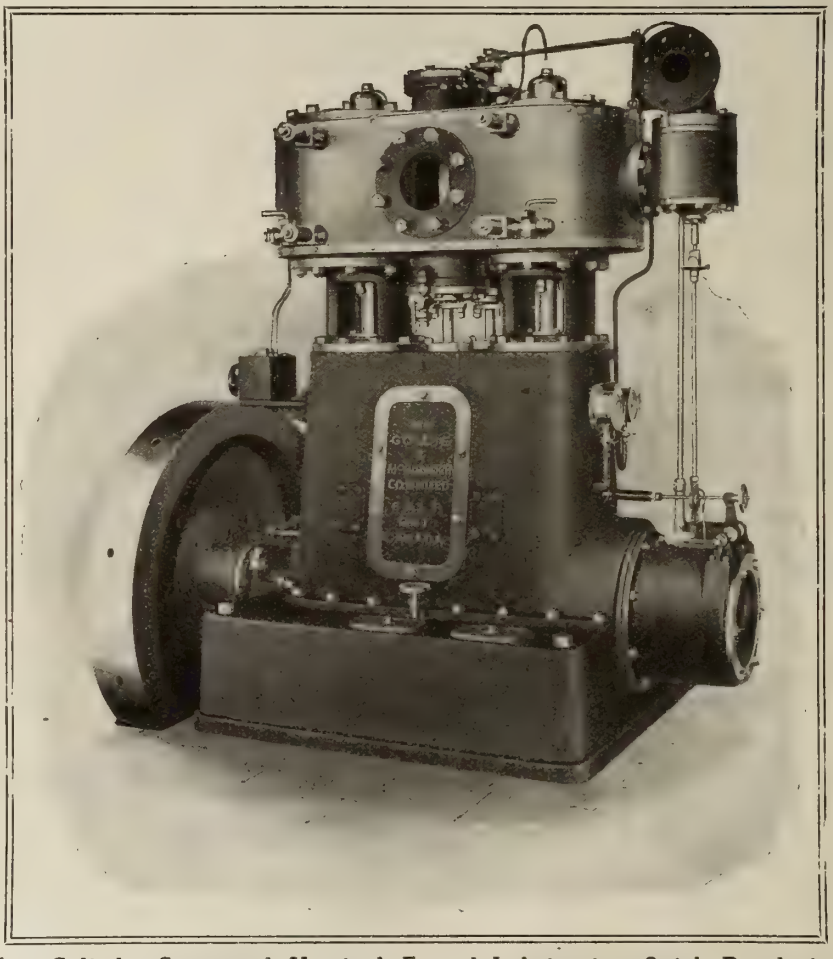
A MAXIMUM OF SERVICE

At a Minimum Cost of Upkeep

These Engines have a Perfect System of forced Lubrication.

They require little or no attention while running.

Built in all types and sizes.



They run with Practically no Noise or Vibration.

All working parts are very easy of Access.

Built to suit your Particular Requirements.

Two Cylinder Compound, Vertical, Forced Lubrication, Quick Revolution Steam Engine, with Combined Throttle and Expansion Governor.

All the materials used in the Manufacture of Vertical, Quick Revolution Engines must be the best obtainable. In the construction of our Engines particular attention has been paid to this feature ; the materials supplied being in accordance with **British Admiralty Specifications.** All Engines are tested under steam before leaving our works.

We shall be pleased to furnish Specifications and further information.

THE GOLDIE & McCULLOCH CO., LIMITED

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1101-2 Traders Bank Bldg.	Ross & Greig, 412 St. James St.	248 McDermott Ave.	Rob't. Hamilton & Co.	13-15 Dock St.

THE NEW GENERAL HOSPITAL POWER PLANT, TORONTO, ONT.

PICTORIAL PLAN OF THE COMPLETED HOSPITAL BUILDINGS AND GROUNDS.

THE new General Hospital Buildings for the City of Toronto have been erected at a cost of approximately $3,000,000. The location is a central one, and the area covered embraces a block of about 9 acres in extent. The main structure fronts on College Street, the buildings on the west, south and east being bounded by University Avenue, Christopher and Elizabeth Streets, respectively. Darling & Pearson, Toronto, were the architects, and their product, as exemplified in the various units, contributes to an improvement to the amenities of the locality, as well as to a high degree achievement in carrying out the beneficent purpose and aim of the institution. The various departments of the hospital work have been housed in more or less separate buildings, the particular location of each being as follows:—

The Administration, Medical and Surgical sections point on College Street; the Pathological, Emergency and Outpatient's section front on University Avenue; while the Obstetrics section, Servants Pavilion, Nurses Home, Private Patient's Department, Power House and Main Grounds front on Elizabeth Street. Provision has been made for the erection of two additional buildings in the future. Occupation has already been made of several sections of the hospital, and everything is likely to be in order for the official opening in the third week of May.

The Power House.

The power house building measures 136 x 40 feet and is of brick and fireproof construction throughout. A brick wall divides the engine and boiler rooms. The latter measures 68 x 40 feet, and the floor, which is of reinforced concrete is set 16 feet below the street level. The height to ceiling is 26 feet.

The engine room floor is set 4 feet above that of the boiler room, the ceiling being, therefore, 22 feet high. The floor and roof are of reinforced concrete construction. It will be noted from the illustrations that splendid natural lighting is provided by numerous windows, these being set close to the ceiling, owing to the basement being so much below the street level.

Boiler Equipment.

The boiler room contains 4 Babcock & Wilcox water tube boilers, set in pairs with access between them from front to rear. Each boiler has a capacity of 500 H.P., at a working steam pressure of 150 lbs. The boilers are fitted with "Murphy" automatic stokers supplied by the Murphy Iron Works Co., Detroit, and with their Dutch oven settings, 8 tons of coal can be stored on the top of each furnace. The fuel is mechanically fed to the fires by means of two 8 H.P. vertical engines, one being fixed at the extreme end of each pair of furnaces. Provision has been made for the installation of two more boilers when these become necessary. The boiler furnaces do not rely entirely on natural draft to keep steam, due to the fact that there are installed, 2 steam driven, 90 inch "Sturtevant" fans. These are connected up in such manner, that either of them, or natural draft can be utilized. They are automatically regulated by the use of a "Bushnell" improved damper regulator operating on the natural draft flue.

Coal and Ash Handling.

Coal is delivered by wagon and dumped through manholes. These are situated directly over the bunkers which run the whole length of the boiler room, and have a capacity of 400 tons. From the bunkers the bins, on the top of each furnace, are filled through the medium of 14ft. space electric crane supplied by John I. Hepburn & Co., Toronto. The crane is fitted with a self-dumping and self-regulating type bucket, capable of handling 900 lbs. of coal per minute. Ashes are raked from the ashpits and removed by the crane to a Turnbull hydraulic lift, installed at the extreme end of the boiler house, which raised them to the street level, and discharged into wagons for removal.

The Incinerator.

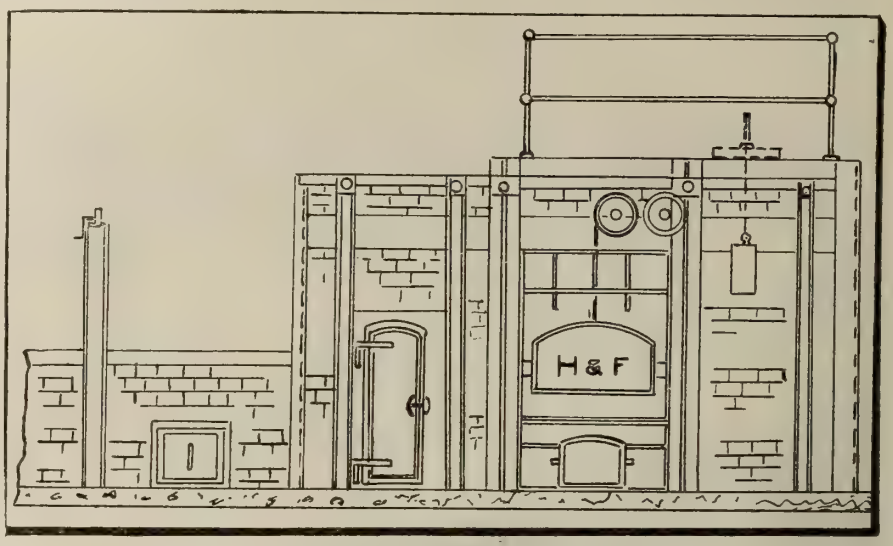
The problem of disposing of the refuse from a hospital deserves particular attention. The destinctor shown in the cut, was installed by Heenan & Froude, England, through Laurie & Lamb, of Montreal. It is erected at one end of the boiler room. In this destructor, provision is made for feeding the refuse, which, in general, is collected in special closed receptacles, through a charging door opening placed on the roof of the furnace immediately over the drying hearth. In this way, the refuse can be discharged instantaneously into the furnace without risk of contact by the operators. After the material has been dried on the hearth, it is raked forward on to the furnace grate, which is provided with a large clinkering door in position, at a convenient height. A forced

draft supply being necessary to burn all classes of low grade waste and refuse; a steam jet blower is installed in a sealed ash pit to produce the necessary draft under pressure. Beyond the furnace proper, is placed a combustion and mattress cremating chamber. This acts as a final mixing chamber, and also as a dust collector in which the great bulk of the latter is deposited.

Main Pumping Plant.

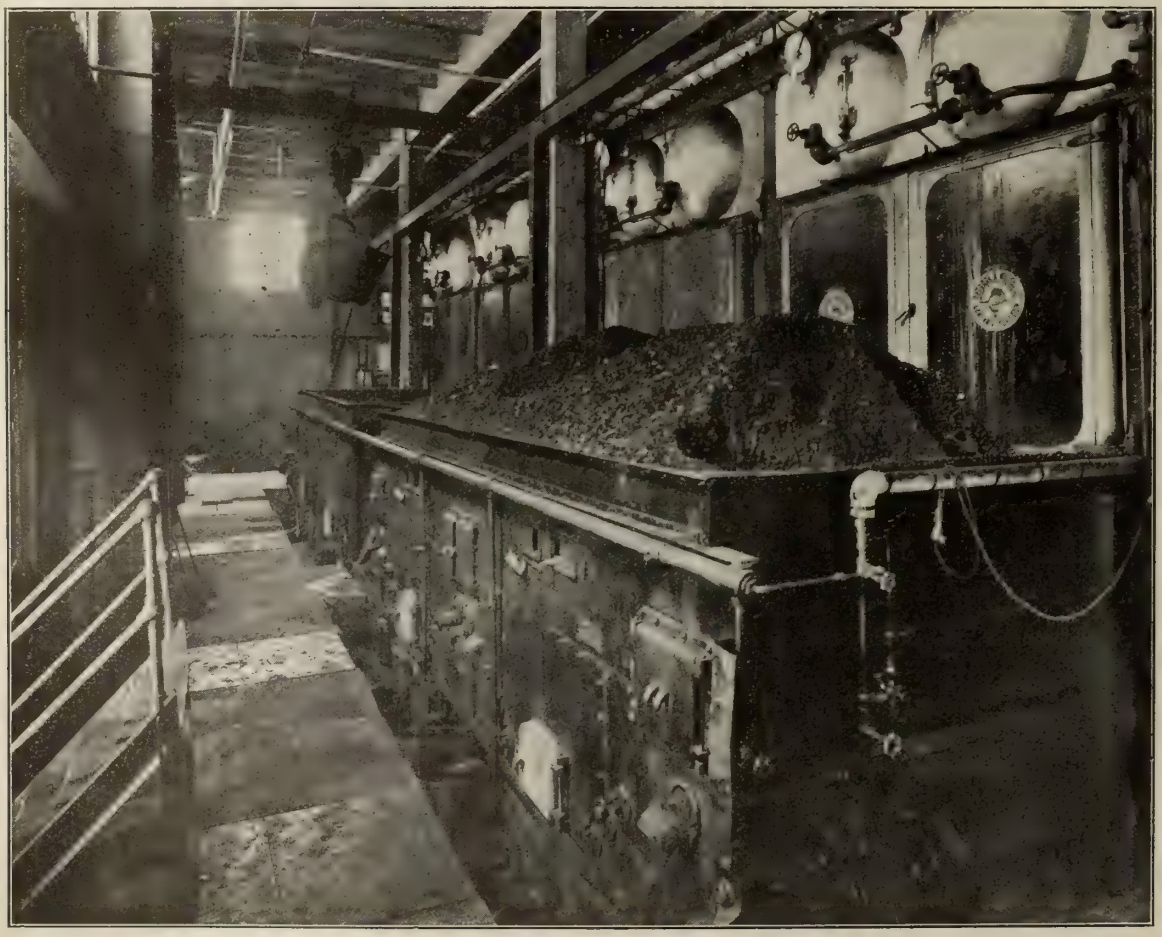
The boiler feed pumping equipment is situated at the back of the boilers, and was supplied by the Smart-Turner Co., Ltd., Hamilton, Ont. It consists of two 7½ x 5 x 10 Duplex pumps, each of which is of sufficient capacity to operate the plant under normal conditions. Should these or the pump line fail, there is connected as an auxiliary a 3-inch Metropolitan injector supplied by the Hayden & Derby Mfg. Co., New York. This will supply sufficient feed water at the peak load. Other pumps in this section consist of three 6 x 5 x 10 Duplex type and one 5¼ x 3½ x 6 Duplex. Installed also in the pump house are two "Detroit" return traps manufactured by the American Blower Co., Detroit.

another source of supply of condensed water is that from the velita coils. This water passes to two receiving tanks set at the back of the boilers, from which it goes to a Cochrane heater installed by The Harrison Safety Boiler Works, Philadelphia in the engine room. From this heater, the boiler feed pumps draw the supply for the boilers.



REFUSE DESTRUCTOR.

non-condensing steam turbines running at 2400 r.p.m. and operating at 140 lbs. pressure, are direct connected to a Canadian General Electric continuous current generator of 125 k.w., the current being generated at 250 volts, 500 amps. A special feature with reference to these sets is that they run 25 per cent. out of balance a condition accounted for by the A.C. collecting rings, which are connected to the compensators at the back of the switch board. The com-



VIEW SHOWING BOILER FRONTS, FURNACES, COAL BINS, OVERHEAD TRAVELLER, ETC.

The two large condensers in the engine room furnish a considerable amount of feed water for the boilers, while

Engine Room Equipment.

The engine generating equipment consists of five units in all. Four Curtis

pensators take care of the out of balance load. The other unit is a Canadian General Electric motor-generator set. This consists of a C.C. generator, direct connected to an A.C. 3 phase, 550 volt induction motor and acts as an auxiliary.

Main Switchboard.

The engine room switchboard was manufactured and installed by the Canadian General Electric Co., Toronto, and is composed of 8 panels of blue Vermont marble, having a total length of 20 feet and a height of 7 feet 6 inches. There are 5 generator panels, the remainder being distributor panels. The switchboard is so arranged that the circuit breaker is on the outside pressure wire of each machine. Two ammeters are connected to the neutral and outside wires of each machine. In the illustration, the two volt meters are seen hung off the switchboard at the right hand top corner. The topmost of these is directly connected to the bus bars and can be used as a ground detector, by simply moving a double throw switch from one side of the line to the other, and by replacing the plug, to engage in three positions. This gives an exact reading of the ground on any line. The bottom voltmeter is direct connected to the machine in operation, and it is necessary for the operator to remove the plug to the panel, belonging to the machine already running.

Each generator panel carries two volt meters, a watt meter and the necessary switches for each unit. A "Westinghouse" Electric graphic recording watt meter, is seen in the illustration. This fully records the daily load generated in the power house, in kilowatts, on a continuous chart. On the distributor panels, the light and power switches

VIEW IN ENGINE ROOM LOOKING FROM BOILER ROOM END.

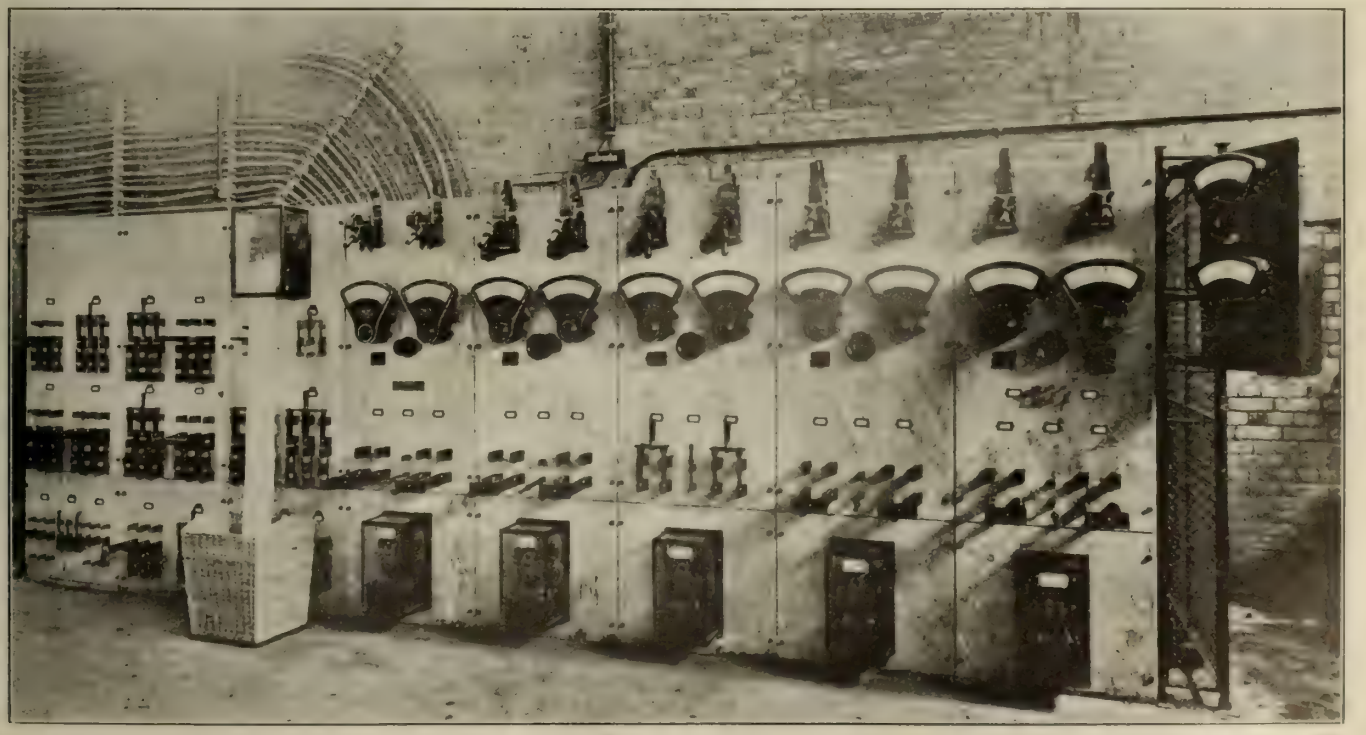
are fixed. These control each building separately.

Distributing Tunnels.

The main tunnel runs from the power house on Elizabeth St. direct to the Pathological Building on University Avenue. Branch tunnels are connected to the main tunnel at intersections. The main leaves the Pathological Building and proceeds North to College Street, afterwards turning East to the end of the main building. From this, another branch is cut through, connecting into the main tunnel near the power house.

Heating and Ventilation.

The whole block of buildings is heated by both direct and indirect radiation, there being approximately 100,000 feet of direct, forced hot water circulation, and about 10,000 feet of indirect. Two large condensers built by the Polson



MAIN SWITCHBOARD.

Iron Works Co., Toronto, are installed in the engine room, having a capacity of 1,500 and 1,000 square feet of surface respectively. They are fitted with ¾in. brass tubes of the corrugated pattern. Two De-Laval steam turbine-driven centrifugal pumps force the water through these condensers.

Two 16 inch pipes leave the engine room, and branches connect up to the different buildings. In each building it has been so arranged that the risers can be shut off and drained out by two ½in. pipes suitably connected. A special feature about the hot water heating system installed in these buildings is that any one pair of risers, or any one separate building, can be shut off, and yet not interrupt other parts of the general heating system. A pair of valves are placed so as to control the two principle heating mains.

It may be of interest to know that the hot water system devised is admitted to be the most flexible possible for the purpose of heating the buildings, the temperature being completely under control, so that it can be raised or lowered at short notice.

Ventilation.

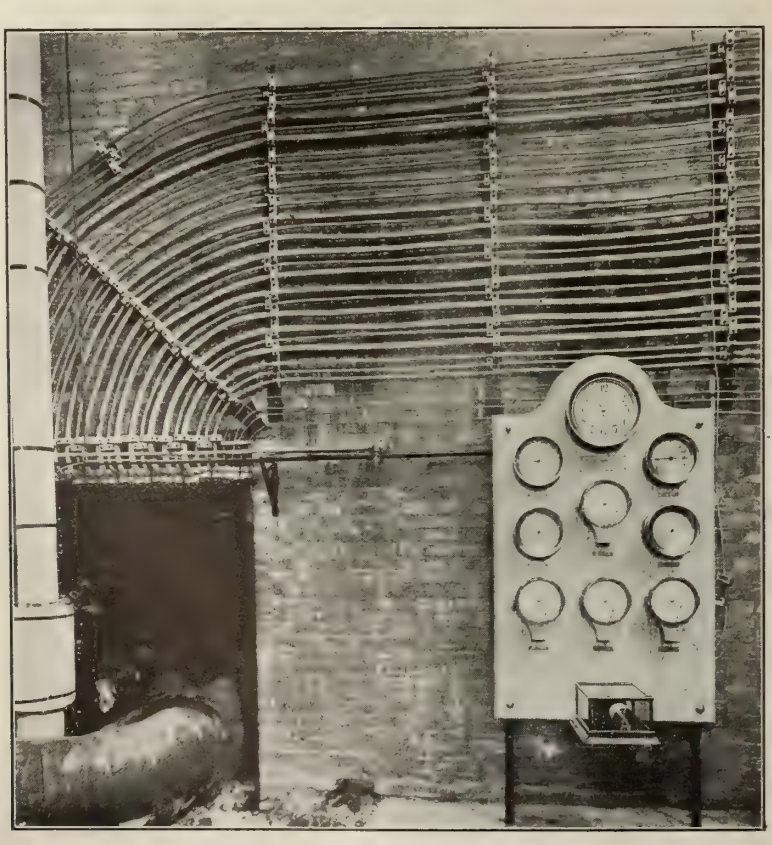
Ventilation is effected by exhaust fans situated in the pent-house on the roof of each building. Fans are also installed in the basement of each building. These are fed by steel ducts. As the airs enters the building it is washed by a water spray, before being distributed by fans to the various wards, ensuring the patients getting a fresh clean supply.

Instrument Board.

The instrument board carries a clock, four Ashcroft pressure guages, four Bristol recording instruments, and an anemometer. Two of the recording instruments give the exact temperature

A. M. GIBSON, CHIEF ENGINEER.

GENERAL VIEW OF LAUNDRY INTERIOR.



VIEW SHOWING INSTRUMENT BOAR D AND DISTRIBUTION TUNNEL MOUTH.

ROBERT CAIRNS, ASSISTANT ENGINEER.

of the flow and return mains, one records the outside temperature, and the other records the boiler pressure. The pressure guages indicate the actual pressure in lbs. of the flow and return mains and the foot head of elevation, of the water in the system. An anemometer is fixed to the bottom of the instrument board, being supplied with current, and having the wires which connect same pass through two lamps, in series multiple, direct from the register to the wind gauge fixed to the top of the Nurses' Home Building. This anemometer registers the velocity of the wind during every twenty-four hours.

Expansion Tank.

The expansion tank is situated at the rear of the condensors, and is always kept three-parts full of water by an automatically regulated flow. A pair of Westinghouse air pumps in the engine room, set on either side of a column, maintain an even pressure. To operate the system satisfactorily it is necessary to keep the pressure always constant.

Nurses' Call.

This special electrical apparatus has been installed by G. J. Beattie, Toronto, and is known as the "Nurs" call system. Should the immediate attention of a nurse be required the patient simply presses a rubber bulb at hand in his or her bed. This procedure lights a red colored electric lamp at the head of the patient's bed, also one on the panel board, and one directly over the entrance to the particular ward. By the use of this equipment the nurse on duty can readily see that her services are required, and by whom. The system is operated with 8-volt lamps, and a separate generator set supplies the current.

Refrigerator Plant.

The refrigerator plant was installed by the Kent Co., Montreal, and has a capacity of 17 tons. The compressor was built by the York Manufacturing Co., York, Pa., and can be clearly seen in one of the cuts of the engine room. It consists of two single cylinders on the compressor side, driven by a single steam cylinder at 150lbs. pressure. The necessary piping is carried to a special chamber situated at the side of the engine room, where two brine circulating pumps are installed, either of which will circulate enough brine to keep the temperature of the cooling rooms, as required, and make ice in addition. The ice tank is built to accommodate fifty pans, and each pan holds a 56lbs. block of ice. Directly over the ice tank is fixed a mono rail for efficiently handling the ice blocks. The ice goes from the tank in each pan to an ice chute, where a steam jet plays upon it, immediately releasing the block of ice from the pan. Provision has been made for storing upwards of 3 tons of ice. The water used in the refrigerator plant is condensed by an aerated water still.

VIEW IN ENGINE ROOM, SHOWING TURBINES AND WESTINGHOUSE AIR PUMP.

Laundry.

Installed in the hospital by The Toronto Laundry Machine Co. is the finest laundry plant yet erected in any hospital in Canada. It is capable of handling 35,000 to 40,000 pieces per week, and provides for operation by 14 hands.

The utensils to be treated are put into metallic washers for the first cleansing operation. Four of these installed will be clearly seen, with the steam issuing from them, on the right hand side of the general laundry view. The washers are driven by a 10 h.p. Canadian General Electric motor, and are constructed with an outside stationary cylinder, which holds the necessary hot water. Revolving inside the cylinder already mentioned is another cylinder into which the clothes are put. This makes three forward revolutions and then automatically reverses its movements, and so on till the particular operation is completed. The washers are erected on concrete foundations over a trench which carries away all the water that falls from the machine. From the washer the clothes are put into an extractor, driven by a 2 h.p. electric motor, and by the centrifugal force thereby obtained the water is extracted from the clothes. The machine installed is fitted with a galvanized iron wire woven safety cover. To start the extractor this cover should be in the down position covering the whole of the clothes' receptacle, otherwise if it be raised for any reason while the machine is running the current is automatically cut off, thus stopping the machine.

The work passes from the extractor to the dry room tumbler, where drying takes from 10 to 30 minutes, according to the nature of the articles. By forcing a continuous current of heated air through and through the clothes as they are tumbled about in the cylinder of the machine the drying process is accomplished. This machine revolves three revolutions and then reverses, as in the case of the washers previously mentioned. For the drying of goods that are not suitable to this machine there are installed sectional drying stoves, into which loaded trucks to the number of four may be run with clothes to be dried. This method of drying is accomplished by a circulating fan placed on the top of each section. It takes from 15 to 30 minutes to dry the four truck loads.

What may be called the most important part of the laundry plant is the flat work ironer. This is clearly shown, and gives a very good idea of its size. No article passes through the machine twice, its capacity being sufficient to iron both sides of the pieces in one operation at a speed of from 30 to 80 feet per minute. The ironing surface is 120 inches long, and has a total ironing and drying surface of 326 feet. This machine is driven by a ¾ h.p. electric motor, with a special speed controller. Other machines installed include a collar ironer and electrically driven body ironers. There are five ironing tables with electric irons.

Elevators.

There are six Turnbull electric and two Turnbull hydraulic elevators, together with three electric elevators made by A. & P. Stevens, Toronto, installed throughout the institution.

Mechanical Staff.

Mr. A. M. Gibson is chief engineer at the hospital, having supervised the engineering section installation since the work commenced. Mr. Robert Cains is the chief assistant engineer. The power house staff consists of 12 men. Connected with the engineering department are up-to-date mechanical and carpentry workshops. These are, of course, adjacent to the power plant.

LARGE BATTERIES.

A PAPER by Mr. F. H. Whysall on "The Use of a Large Lighting Battery in Connection with Central Station Supply," was read recently before the Institution of Electrical Engineers. It referred mainly to the results obtained during two years' working of the 12,000 ampere-hour battery installed in March, 1910, at the Manchester Corporation Electricity Works, which at that time was the largest battery ever constructed. The paper also showed to what extent the predictions regarding the use of the battery have been fulfilled and the relief obtained in the cost per unit supplied.

Composition of Battery.

The author said that the battery consisted of 210 cells, each cell containing 38 positive plates and 39 negative plates of the following dimensions:—Positive plates, 20¾in. wide by 29in. deep by 0.4in. thick; negative plates, 20¾in. wide by 29in. deep by 0.31in. thick. The positive plates were of the Plante formation, cast in one piece, but the negative plates were of the improved box type composed of half-grids securely riveted together, the spaces between them being filled with active material. Specially impregnated wooden separators were employed between adjacent plates, and a free space of 8in. was left at the bottom of the cell for the accumulation of deposit.

Duty of the Battery.

The chief duty of the battery was to take 3,000 kw. off the lighting peak. It was also regarded as a standby. Its chief duty, however, was load-levelling; it was, therefore, decided to have three hand-regulated reversible boosters, and to run them in parallel at times of maximum discharge. At other times one or two would be used as required. It might be noted, however, that such importance was attached to the question of overload in emergency that it was the universal custom on the Continent to use regulating cells in all central station batteries.

The improvement in load factor on the units generated, observed monthly over two years, was approximately 7½ per cent., and the value obtained from the chart on 30½ million units representing a saving of $50,830. There were, therefore, two distinct annual savings on running charges due to the battery: (1) Standby boiler fuel costs; (2) difference between steam generation at 8 per cent. load factor and bare fuel cost.

3,000 TON TESTING MACHINE.

THE 3,000-ton testing machine erected last year in the Royal Testing Station in Berlin is operated hydraulically, and is designed to receive struts and tension members 50 ft. long. In using this apparatus, special attention is paid to flexure and collapse of columns, and resistence of riveted joints. All heavy parts of the machine are of forged steel. According to the Zeitschrift des Vereines deutscher Ingenieure, two 200-atmosphere water pressure buffers are provided to absorb the shock when rupture takes place. The high pressure pistons are packed with cup leathers.

HIS IDEA FOR CONSUMING SMOKE.

Evening Telegraph Reporter—"What would you consider a good smoke consumer?"

Property Commissioner Chisholm—"A good smoke consumer should be arranged to suck the smoke around to the back of the fire, then draw it underneath and force it through hot coals. If this is done properly almost all the soot will be burned."

Be it noted that the above sublime effusion is not more than a couple of days old, and in its brevity and confident tone speaks volumes for the intelligence and wealth of research unfolded to the citizens of Canada's Queen City by one of her officials.

ELECTRIC LOCOMOTIVES.

THE Electric Railway Journal points out that in the United States it is customary to employ a series of small and large circles or a succession of numerals to express the arrangement of the pony and driving wheels of electric locomotives. On the Continent the pictorial method is dispensed with, while the purely numerical arrangement, showing the number of each kind of wheel, is replaced by a combination in which a numeral represents the number of pony axles and an initial capital letter the number of driving axles. Thus, a locomotive with four driving axles only is designated as type D, instead of 0-4-0. Similarly, type 1-C-1 means one leading axle, three driving axles, and one trailer axle—a combination which Americans would designate as a type 2-6-2 machine. The plus (+) sign is used to show the division of driving axles on separate trucks. Consequently, a C + C locomotive is one with three driving axles in each of two trucks. This method of combining numerals and capital letters is as convenient to express or write as plain numbers, with the additional advantage that the typographical contrast between the numbers and letters emphasises the difference between the two types of axles almost as effectively as the circles.

SUPERHEAT REGULATION.

THE usual mode of regulating superheat is by means of flap valves or gates in the flues, which regulate the flow of flue gases past the superheating coils. These gates, etc., are exposed to high temperatures and being difficult of access, easily get into a condition such that they jam or move with difficulty. A patent has been taken out in Germany for an arrangement which gives improved regulation without these disadvantages. The superheater is placed under the water drum, and the superheated steam passes from it through a pipe in the hot boiler water to the main steam supply, where it may be mixed with saturated steam in any desired proportion by means of a suitable mixing valve.

INCREASED MINERAL OUTPUT.

AN increase of $29,906,495, or nearly 29 per cent. is shown by the preliminary report on the mineral production of Canada during 1912. The total value of the year's production was $133,127,489, and nearly every important mineral in Canada shows an increased production, so far as value is concerned. In the case of silver only, is there a decrease in quantity, and this is but two per cent., the increase in total value of the silver mined being due to higher prices.

Increase in outputs are as follows:—Pig iron, 10.5; gold, 28; copper, 40; and lead 50 per cent. Increases in total values are:—Silver, 12; nickel, 31; copper, 85; and lead 93 per cent. Coal shows an increase of 30 per cent. in tonnage, gypsum 11, and cement 26. Ontario is credited with 38 per cent. of the total production, or $51,023,134, while British Columbia, Nova Scotia, Alberta and Quebec follow in the order named.

Hydro-Electric Plant of the Western Canada Power Co.

By C. T. R.

This is one of the most important hydraulic equipments yet installed in Canada by Escher Wyss & Co., Zurich, Switzerland, and now that some fourteen months' highly satisfactory operation falls to be recorded, a few details of the plant will doubtless be of interest.

THE power station of the Western Canada Power Co., is located about 35 miles from Vancouver, B.C., at the Stave River Falls and utilizes a fall of about 110 ft. By building two dams at the upper side of Stave Falls a large reservoir reaching to the upper end of Stave Lake, a distance of 16 miles has been created with an area of 18 square miles. This storage capacity, together with the flow of the river, is sufficient for 28,000 H.P. continuously, and for a peak load of 50,000 H.P. By raising the dams, additional storage can be obtained and the plant brought up to the full capacity of 100,000 H.P.

Plant Features.

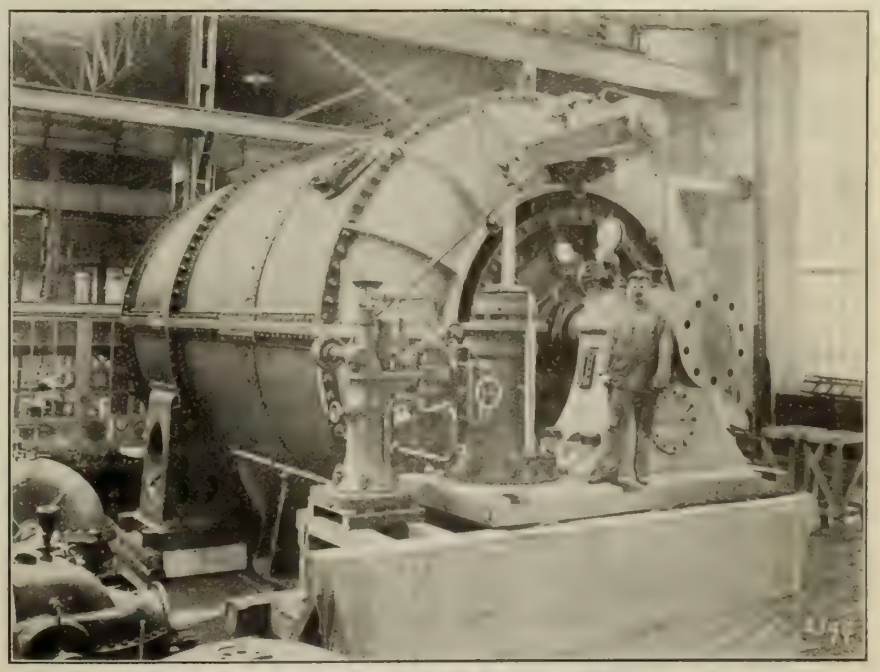
At present, 26,000 H.P. are developed, two units of 13,000 H.P. being installed. The water is taken from a forebay by means of two penstocks, each of 14ft. 6 in. diameter and having a total length of 150 ft. The penstocks for the two exciter turbines are 4 ft. in diameter. The turbines are of the Francis type with horizontal shaft, double wheels and central discharge, delivering through a short draught tube formed in concrete to the tail-race. The level of the water in the tail-race is kept constant at elevation 110 ft. The level of the water in the forebay varies from a minimum of 210 ft. to a maximum of 230 ft., the head varying thus from 100 ft. to 120 ft. The average is 110 ft., and under this, the turbines have to give a maximum of 13,000 H.P. on the shaft when running at a speed of 225 r.p.m.

Turbine Construction Features.

The wheel casing is of steel plate, and heavy steel angles, and is divided horizontally so that the upper part can be removed for easy access to the turbine. Heavy angle irons stiffen the casing so that it cannot spring out of shape when taken apart. To connect the casing to the penstock, a taper piece is inserted. The main cover is of cast steel, strong enough to withstand a pressure amounting to twice that due to the static head. The bearings are of extra large dimensions, the generator bearing being arranged in such a way that it can be sunk by taking out an intermediate piece under the pedestal so as to allow for dismantling of the shaft. The outer bearing is protected by a housing, into which access is allowed by means of a steel tube. There is a considerable distance between the two bearings, but Escher Wyss & Co. consider this arrangement better than to have a third bearing inside the draught chest which is not free to inspection, thereby introducing a weak point in the design.

The shaft is made in one piece and of sufficient thickness at the centre to revolve without the support of a middle bearing and without undue deflection. The half couplings are forged on both the generator and the turbine shaft. A strong cast iron foundation frame supports rigidly the draught chest and cover. No steel girders are used as foundation, the whole being grouted in concrete. Considerable difficulty was experienced by the steel founders in producing the cast steel runners, but in the end faultless casts were obtained, and the high efficiency these runners have shown reflects credit on the designers. The guide vanes are of cast steel, and all steel bolts are provided with stuffing boxes and bronze bushings so as to guarantee smooth working and possibility of dismantling. The regulating rings have been given a profile of maximum possible resistance and stiffness, which in this case is of great importance, as the diameter of the ring is 9 ft. These rings as well as all covers, stuffing boxes, etc., are split horizontally. A regulating shaft of 10 inches diameter supported by white metal bearings mounted on the draught chest, operates the regulating rings. The shaft, on the other hand, is operated direct from the servo-motor working under oil pressure supplied by an oil pumping plant. The speed governor is driven by belt from the main shaft, the arrangement being shown on the illustration.

The servo-motor consists of a differential cylinder, which, by means of pressure oil from the air vessel, produces the power required for moving the governor gearing of the turbine. Pipes from either side of the piston connect to the controlling valve mounted on the casing. This valve contains several chambers communicating with the respective serve-motor chambers and oil tank. The spring pendulum contains fly-weights loaded by compressed springs. The larger springs are supported by the pendulum casing, the smaller ones by the movable discs, the latter being adjustable in the radial direction, whereby the compression of the springs and the speed of the pendulum is varied. The speed can be regulated by turning a handwheel on the governor or from the switchboard by means of a small electric motor mounted on the pendulum. The pendulum shaft is driven by worm wheels from the horizontal



FRONT VIEW OF 13,000 H.P. TURBINE, ERECTED AT ESCHER, WYSS & CO. WORKS, ZURICH, SWITZERLAND.

shaft, which latter is driven by belt from the turbine shaft. The movement of the fly-weights in the pendulum is transmitted to the regulating lever. A relay consisting of a dash pot serves as a second compensation device. Governing by hand can be effected by means of a hand governing valve, which admits pressure to one or the other side of the servo-motor piston.

The oil pressure necessary for the governors of both turbines is supplied by an independent plant. It consists of two complete units, each unit being capable of supplying under normal conditions the necessary pressure of oil for the governors of the two main and the two exciter turbines. Each unit consists of an impulse wheel direct connected to a three cylinder single acting oil pressure pump which draws the oil from an oil tank and forces it into a strong air chamber, whence the governors of the turbines are fed. After leaving the governors, the oil in flowing back to the oil tank passes through an oil filter. The impulse wheels receive water through pipes connected to the exciter pipeline.

Exciter Turbines.

The exciter turbines are single wheel Francis units with horizontal shaft in spiral casing, each designed for 500 b.h.p. when running at a speed of 500 r.p.m. They are fitted with the Escher Wyss & Co. patent universal oil pressure governor of standard type, and are direct connected to two exciters.

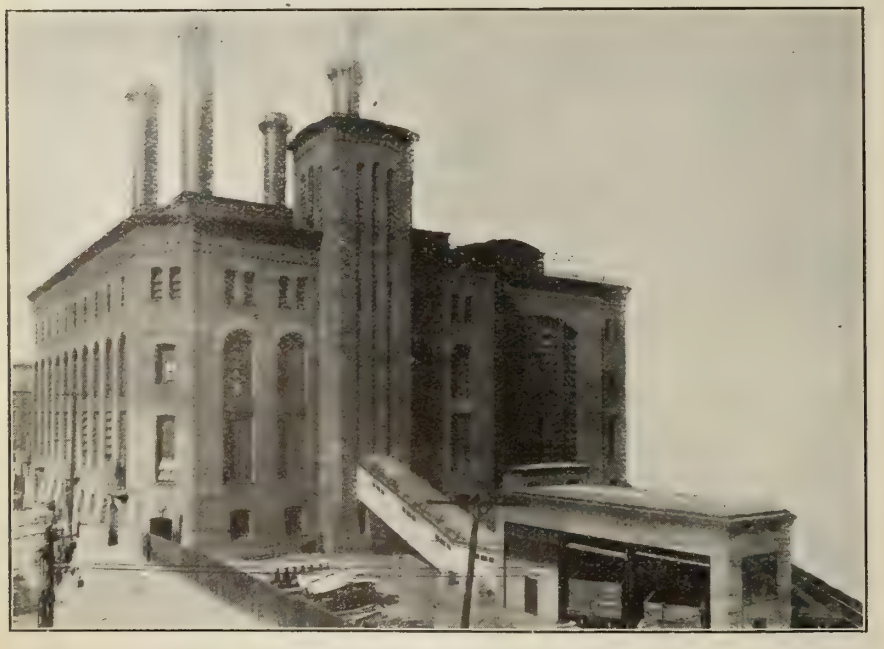


FIG. 1. GENERAL VIEW, THE HUDSON AND MANHATTAN RAILROAD POWER HOUSE.

Electrical Equipment.

The electrical equipment of the power station, which was supplied by the Canadian General Electric Co. consists of 2 generators having a nominal capacity of 7,500 K.W. each and 2 exciters rated at 250 K.W. each. They are capable of giving a continuous overload of 25 per cent., and are producing continuously 9,375 K.W. at a power factor of 85 per cent. The normal voltage is 4,000, periodicity 60 cycles. A speed of 75 per cent. in excess of the normal is guaranteed. The transmission line from the power house to the receiving station is designed for 60,000 volts.

The plant was first started up in December 1911, and, according to a statement made by the Western Canada Power Co., not the slightest difficulty has been experienced, neither on the hydraulic nor the electrical machinery. The weight of the water wheels is 165 tons per piece, while the generators weigh 160 tons each.

HUDSON AND MANHATTAN RAILROAD POWER HOUSE.

By Chas. H. Hughes.

THE power herewith described and illustrated is one of the large, interesting and up-to-date power houses in New York City, and supplies electrical energy to the Hudson and Manhattan Railroad Co., who operate two tunnels under the Hudson River, a subway in New York, another in Jersey City, besides a few miles of open track, also in Jersey City. The traffic is inter-city, and from its nature must be quickly handled; therefore, electrically-operated trains were selected instead of steam.

The electric system as planned consists of a main power house at Jersey City, three sub-stations, two in New York and the other in the power station itself. The current generated is three-phase, 25 cycle, 11,000 volt alternating, converted at the sub-stations to 430 a.c., then transformed to 615 volt d.c., fed to a third rail, from which the cars take it. The monthly output is 3,500 k.w. hours, and the maximum hourly 13,000 k.w. About 190 cars are run during rush hours, the cars being larger than those on the ordinary trolley roads, but not as large as those on steam railroads. The station at Jersey City was built primarily to operate cars in the tunnels and subways, although at one of the sub-stations considerable electricity is used for lighting and also for power purposes in the Hudson Terminal Buildings—two of the largest buildings in New York.

The Building.

The power station is located in Jersey City, practically at the centre of the Hudson and Manhattan Railroad System. The location is a good one, not only from an electrification distribution standpoint, but also for the ease with which coal can be shipped to it, and the abundance of water that can be obtained from the Hudson River for condensing purposes. It is accessible to all railroads entering Jersey City, and coal can be brought directly from the mines. The present station is 196 feet long, 210 feet wide, and should an annex be necessary provision has been made. The building is of brick, with steel columns, without special features except the large tower, which houses the coal and ash handling equipment.

Particular attention has been paid to the lighting; in fact, the generating room is so well lighted by windows and skylights that only at night is it necessary to use artificial light, when recourse is had to Cooper-Hewitt mercury vapor lamps running on direct current. For local lighting, alternating current incandescent lamps are used. Most of the windows have pivoted sashes, and as a protection against fire are fitted with wire glass. Moreover, the window frames and doors are of metal, and the entire structure has been designed to be as nearly fireproof as possible.

Boiler Room.

The boiler and generating rooms are on the same level, and over the former is the coal bunker. The ultimate installation will be 16 900 h.p. Babcock & Wilcox boilers (now being installed), each having 9,000 square feet of heating surface, four drums and a superheater. Referring to the plan of the boiler room, it will be noticed that the boilers are in rows of four, back to back, with aisles at right angles to the turbine rooms—this arrangement shortens and simplifies the pipe lines. Every boiler is equipped with two McClave Brooks hand-fired grates, divided into sections

for convenience in cleaning the flues. The balanced draft system is employed, four large fans discharging into an air duct connected to the ash pits.

The method of covering the boilers is worthy of notice. The brick work over them is 12 inches thick, while at the furnaces it is about 25 inches. Outside the brickwork is a 2-inch layer of 85 per cent. magnesia, and then a steel casing. To prevent the radiation of heat all the doors and frames on the settings are of special design, and where possible are packed or covered with asbestos. The settings with the doors are made air-tight.

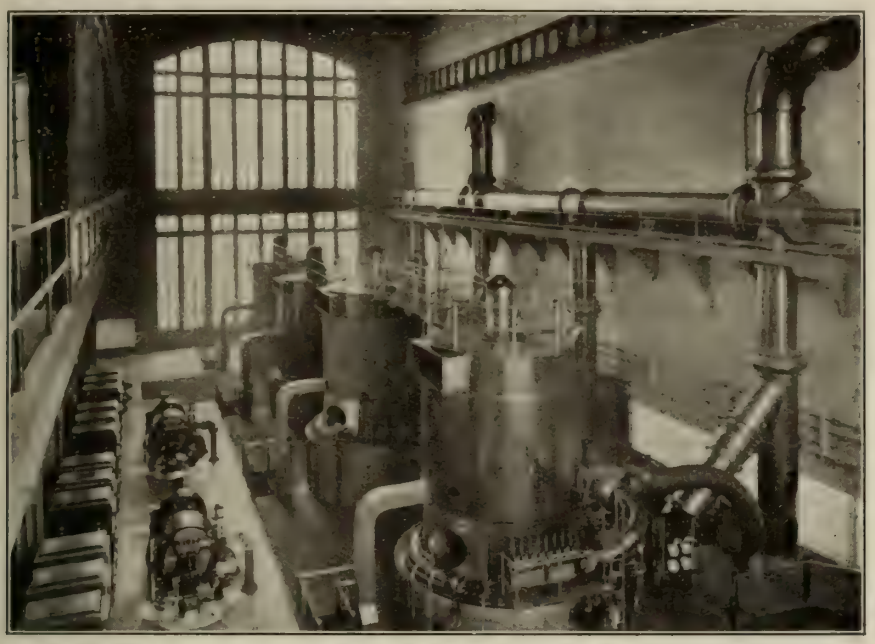


FIG. 2. INTERIOR VIEW OF GENERATOR ROOM, HUDSON AND MANHATTAN RAILROAD POWER HOUSE.

At the rear of each boiler, forming part of the setting, is a green fuel economizer, four of which in connection with four boilers and two uptakes lead to a single steel stack lined with brick, having an internal diameter of 11 feet and a height of 190 feet above the curb. It is interesting to find that, although the boilers are supposed to develop under normal conditions, 900 h.p. apiece, yet during rush hours, when the passenger traffic is very heavy, they are forced to nearly double the capacity—often developing 1,800 h.p.

Coal and Ash Handling.

Coal is delivered by cars to an unloading house, and there discharged into a hopper, from which it is conveyed by two 30-inch Robins belt conveyors to the receiving hopper in the station. Here it goes to the crusher, and afterwards to the weighing hoppers. From the latter it is dumped into skip hoists and raised by them to the top of the tower and emptied onto belt conveyors. The conveyors run over the bunkers, the coal being discharged automatically. From the bunkers there are cast iron chutes which bring the coal to the fire room floor.

The ashes are handled as follows:—Below each boiler are two brick-lined hoppers, emptying into cars, which in turn discharge into skip hoists. These deliver either to a car on a track or to a large storage bin.

Generator Room.

Current is generated by two 3,000 k.w. General Electric Curtis turbo-generators, of the five-stage, vertical shaft type, using steam at 175 lbs. pressure, with a superheat of 100 degrees Fahr. A unique feature of the units is the cooling, the air being taken in at a large rectangular opening near the top, and discharged through ellipitical ones at the bottom. If desired, all the rectangular openings could be connected to a common duct, and outside air used instead of that in the generator room. An efficient lubricating system for the journals and step bearings is provided, the oil being forced through under great pressure. Four steam driven pumps, with extra heavy cylinders, are used, each pump having a capacity of 20 gallons per minute at a pressure of 1,100 lbs. per square inch. To maintain a constant pressure a large accumulator is employed.

The generators, which furnish three-phase, 25 cycle, 11,000 volt alternating current, have stationary armatures and a revolving field. For exciting, two 150 k.w. turbine generators and one 150 k.w. motor generator set are required. The turbines are run condensing, five condensers being employed, having an aggregate area of 70,000 square feet of cooling surface. The usual centrifugal pumps for circulating the water and air pumps are installed. The steam piping has been designed to be as flexible as possible, large bends being used to allow for expansion and contraction. The Holly drip system returns water condensed in the high pressure steam lines to the boilers. The valves, fittings and flanges are exceptionally heavy.

Robins & Oakman, of New York, were the architects for the station, while mechanical and electrical equipment was designed and installed by L. B. Stillwell and associates, also of New York.

WATER WORKS INEFFICIENCY.

NINETY-FIVE and a half million dollars are invested in waterworks systems in Canadian towns and cities. The annual outlay for maintenance, exclusive of interest, amounts to $3,435,199. There are in all 5,215 miles of mains in use, and the total daily consumption of water passing through these reaches 360,477,638 imperial gallons. These are the figures obtained by an investigation just completed by the Commission of Conservation, the results of which are being published as a report on the Waterworks of Canada. They indicate something of the magnitude of the investments that are placed in Canadian public service utilities. By far the larger number of these plants are owned by municipalities, but a few of the smaller ones are owned and operated by private individuals or corporations.

A Glimpse at the Details.

An examination of the details which go to make up these totals present some interesting conditions. Thus, the estimated cost of supplying water varies from seven cents per 1,000 gallons for the municipalities of Nova Scotia to 23 cents per 1,000 gallons for those of Saskatchewan, with costs in the other provinces ranging between these extremes.

In Saskatchewan, where the cost of delivery is higher than in any of the other provinces, the amount of water used is much less. In the City of Moose Jaw, for example, the daily consumption rate is only 15 gallons per head of population. All the water is metered and no flat rates are levied. The meter rates range from 10 cents to 25 cents per 100 cubic feet, somewhat below the average for the province. In the matter of meter rates, however, there is an exceedingly wide variation in Saskatchewan. In one small town these rates range from 25 cents to 75 cents per 100 cubic feet.

Waste of Water.

In Eastern Canada the consumption rate is more uniform, but there are indications of considerable waste in many

cities. Last year an Ontario city employed experts to ascertain the cause of waste. They found some serious leaks in mains, as well as wastage by individual users. The expert engineer in his report says:

"Water is pumped at the present time at the rate of about 190 Imperial gallons per capita daily, and at least three-fourths of this water is wasted without being of benefit to any one. Some of this wasted water is due, no doubt, to leaks in the pipe system, but probably most of it escapes from leaky plumbing fixtures in the houses and shops of the city." One hundred and ninety gallons of water weigh nearly one ton, so that this city is each and every day in the year pumping four and a half tons of water for each family of five persons. The average consumer may truthfully say that he is not using that amount of water, yet he is paying for it, and, if of the well-to-do class, probably for more than that amount.

The above example is not unique in any way, for there are very few cities on the North American Continent in which enormous water waste cannot be found, and this, despite the well-known fact that it is only necessary to install meters to put a stop to it.

The Canadian who is really patriotic cannot do better than consider carefully this question, particularly as far as it affects his own municipality. It is axiomatic to a waterworks expert that fifty gallons of water per head of population is ample, and that—unless water is used for irrigation or similar purposes—what is pumped over and above that amount is wasted.

COMPRESSED AIR AND ITS MEASUREMENT.

A PAPER entitled "Some Applications of Compressed Air and its Measurement" was recently read before the Liverpool Engineering Society. The author referred mainly to the operation of steam hammers by steam, electricity and compressed air.

Given fairly cheap power for compressor driving, he said, compressed air hammers, properly designed for the purpose, afforded a palpable advance on ordinary steam hammer practice. In any but the very smallest installations, the matter of air compressing, storage, and distributing plant warranted most careful attention. One point well known in theory, but very often ignored in practice was that air compressors should be supplied with cool, clean air as dry as possible. After compression, the heated air should be cooled or allowed to cool before it passed into the air mains; otherwise cooling in the mains would entail deposition of moisture which gradually collected and was driven forward with grit and rust, finally causing trouble in the working parts of the apparatus with which it came in contact.

Installation Features.

Compressed air could be conveyed through pipes for a long distance with practically no loss, especially where the demand was intermittent, and where a supplementary air receiver was placed at or near the end of the air main, remote from the compressor. In large installations, the air compressors required large units of power to drive them, and it was good practice to couple them as directly as possible with the prime movers, with consequent improvement in capital costs and power transmission efficiencies. As a definite example, a compressor requiring 100 h.p. to drive it might be considered. The ideal arrangement would comprise a prime mover capable of driving this compressor and direct coupled to it. On the other hand, where there existed an electric power generating station, the tendency was to place the air compressor near the department where the compressed air was required and to transmit power to it electrically. Under such conditions, the sequence of plant would probably be as follows:

Prime mover, electricity generator, switches and instruments, transmission cables, motor and starter, and power transmission to compressor crank shaft. Each conversion of energy entailed a serious loss, and instead of a transmission efficiency of 95 per cent. with the simple arrangement, probably less than 75 per cent. efficiency would be obtained under the electric transmission arrangement, while there would be a much increased capital expenditure on account of generator, instruments and switch gear, cables, motor, and a necessarily large prime mover.

Air Leakage.

It was sometimes advanced, as an objection to compressed air as a power transmitting agent, that leakage was liable to be a great and unknown quantity. The uncertainty as to the rate of consumption of compressed air by the various items of apparatus to which it was supplied and the continuance of the good efficiency of the air compressors had always been a cause of uneasiness to the engineers responsible for the good working of an installation of any considerable magnitude To meet the requirements of the case, the author had designed a combination of variable orifice and manometer. The variable orifice was in the form of an accurately constructed sluice valve, and the manometer, which was not provided with any scale, simply indicated with great certainty and precision one particular pressure difference which might be caused by more or less closing the valve to the flow of air. The valve, which could serve as an ordinary stop valve, was inserted in the pipe line, and was fitted with a scale to indicate the precise amount of opening, and, consequently, the precise amount of throttling of the flow, which produced that one pressure difference under which the manometer was operative.

STEAM BOILER REGULATIONS.

IN the new regulations for the inspection of steam boilers, which under proclamation will be brought into effect on the first of July next, practical uniformity is achieved between all the Provinces of the Dominion.

These regulations which are the product of much negotiation and consideration between the representatives of Ontario, Quebec, Manitoba, Saskatchewan, Alberta and British Columbia, provide for the rigid inspection of all boilers under construction, to see that proper materials are used and safe methods of construction employed. The object is to secure a uniform standard that will insure a maximum degree of safety on the one hand, and enable a certificate granted in respect of a boiler in one Province to be accepted by any of the others. Quebec and Manitoba have not yet brought their regulations into force, but this will be done at an early date.

To carry out the provisions of the Act, Provinces will be divided into districts with a chief inspector and two or three assistant inspectors. These inspectors will be given ample discretionary power in their work, with authority to insist on a proper standard of efficiency being maintained. Hitherto, there has been no such system of inspection. Steamboat and railway boilers are not included, as these are dealt with otherwise.

The estimates for the current year will provide for the salaries of the inspectors and the necessary organization.

Fredericton, N.B.—Two fire stations, to cost $30,000 are contemplated by the city council.

Ottawa, Ont.—The advice of British experts will be adopted, and about $7,000,000 spent to bring water from the Gatineau Lakes, by a route either forty or sixty miles long. It will take three years to complete. A chlorination plant on Lemieux island costing $17,000 will be built.

The Explosion of a Sulphite Digester at Grand Mere, P.Q.

By "Laurentine"

Explosions of steam boilers and other kindred vessels subject to pressure are happily rare in the Dominion of Canada, a circumstance due largely to the combination of effort put forth by designers, constructors, operators and inspectors of these utilities, to secure such a consummation. Readers of The Power House will find instruction and food for thought in the contents of this article.

MANY serious explosions of vessels operating under steam pressure have taken place in Canada, but all have been eclipsed by that of a sulphite digester which occurred in the works of the Laurentide Company, Limited, Grand Mere, P.Q., about 10 p.m. on December 22nd last. The digester house, a solid structure of brick, cement, and steel, about 30 feet wide, 120 feet long and 80 feet high, was practically wrecked, and its contents destroyed. Adjacent buildings within a radius of 150 yards were also damaged. Three lives were lost and two persons injured. That the loss of life was not greater was due solely to the hour at which the disaster happened.

Digester Features.

A digester is a vessel somewhat similar in construction to a vertical steam boiler, but with conical ends, as seen in fig. 1. It is used in the manufacture of paper from pulp wood, and where the wood is treated with acid the vessel is lined with a thin lining of lead, which in turn is covered with cement and tiled to prevent the acid coming in contact with the steel plates.

The Toll of Damage.

The illustrations accompanying this article will give some idea of the tremendous damage done by the explosion, for although over 200 men were kept at work clearing the wreckage, nearly three weeks elapsed before a sufficient quantity of the debris was removed to enable the work of adjustment to be proceeded with. The damage to property alone amounted to $79,763.76, which loss was fully covered by insurance with the Boiler Inspection and Insurance Co. of Canada, and was paid by that company on Monday, 27th January last, the proofs of loss having been received on the previous Saturday.

Exploded Digester Construction.

The exploded digester was one of three operated by The Laurentide Co., having been built in 1898. It was 45 feet high by 14 feet in diameter, and consisted of 3 courses of 3 plates to each course. The plates were of steel, 1 inch thick, joined together by butt

FIG. 2. DIGESTER SHOWN EXTREME LEFT OF FIG. 1.

joints, with single covering straps 1 1-16 inches thick. The vertical seams had three rows of rivets on each side of the joint, and the circumferential seams two rows. The lead lining was about 5/8-inch thick, over which there were two layers of cement and brick, the lining between 8 inches and 9 inches thick. The digester was operated at a pressure of between 85lbs. and 90lbs. per square inch. It was not only regularly inspected by the insurance company, but also by the owners themselves, who had omitted no precaution to ensure continual safe operation.

The Explosion Feature.

The initial rupture occurred in the covering strap on one of the vertical seams of the middle course of the vessel. This rupture extended along the covering straps of the circumferential seams of the middle course, which was also torn from the upper and lower portions of the vessel; the straps tearing apart in some places and the rivets in others, no tears occurring in the shell sheets at any point. When the centre course separated from the two ends of the digester, the top portion appears to have been blown directly upwards, falling back on the foundation, while the

FIG. 1. THE WRECKED DIGESTER BUILDING.

lower portion was blown through the south wall of the building, falling on and destoying the blow tanks used to receive the "cook" when the digesters were emptied. The middle course, consisting of three sheets, was lying on top of the lower portion and was straightened out almost flat.

Probable Cause of Explosion.

The initial fracture was apparently due to a hidden crack in the strap, which started from the inner surface and worked towards the exterior. It was a defect similar in character to the defect known as "lap-joint crack," a well known cause of several serious boiler explosions, notably the explosion at Brockton, Mass., on March 20th, 1905, which resulted in the death of 58 persons, injury to 117 others, and property loss of $250,000, $80,000 of which was due to the destruction caused by the explosion, the balance being due to the fire that followed. The boiler explosion in the works of Wm. Cane & Son, Ltd., at Newmarket, Ont., on November 19th, 1903, causing the death of two persons, injuries to several, and property loss estimated at $25,000, was due to the same defect.

The assumption that a hidden crack was the cause of the rupture is strengthened, if not confirmed, by the fact that another of the vertical straps on the same course was found to have a crack on its inner surface, about two-thirds of its entire length, and in a position which a crack of this nature would be expected to occupy. A vertical strap removed from one of the other digesters was also cracked in a similar manner.

Covering Straps Only Defective.

The fact that the failure of material was confined solely to the straps and that none of the sheets of the exploded digester were torn would indicate that the material in the straps was of poorer quality than that in the sheets. Had this strap been less brittle and more elastic, and of the same quality as the sheets, it would probably have withstood for a much longer period the repeated application of the internal strains imposed upon it whenever the digester was put into operation, strains due to the pressure of steam and water and the expansion of the lining.

Impression Left by the Disaster.

The consequence of such a disaster as that at Grand Mere will naturally impress on those connected with or interested in the operation of digesters the tremendous destructive force contained within them, the various hazards connected with their use, and the necessity of overlooking no means that will tend to minimize each and all of those hazards. It is to be sincerely hoped that the passing of time without a recurrence of a similar disaster will not have the perhaps natural effect of lulling those using these vessels into a false sense of security—a condition of the human mind that would be apt to minimize the necessity of sparing no expense and overlooking no precaution for the purpose of ensuring their safe operation.

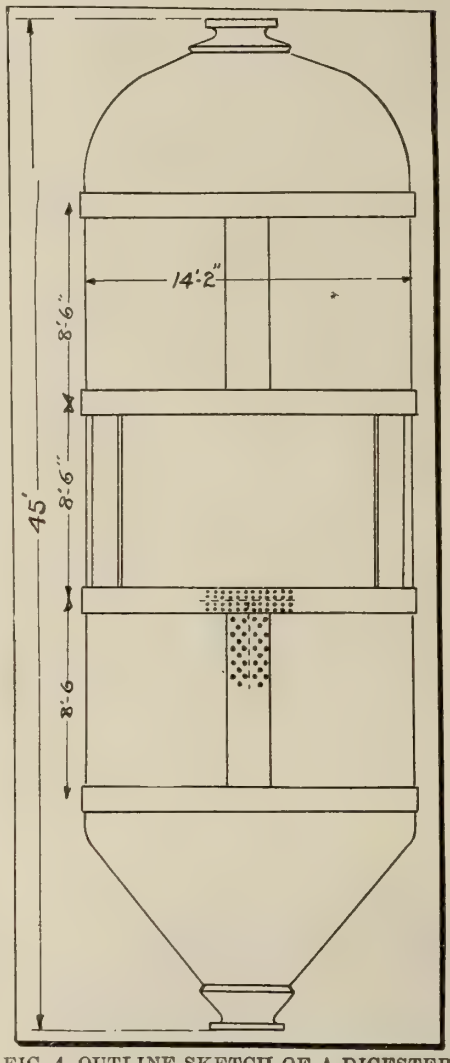


FIG. 4. OUTLINE SKETCH OF A DIGESTER VESSEL.

More Safety Provision in Construction.

The majority of digesters in use today are of single strap construction. They are subject to the strains caused by the internal pressure of steam and water and the expansion of the brick lining. The possible effect of these strains on the covering straps of the vertical joints calls imperatively for the use of a larger factor of safety than would be necessary in the case of an ordinary steam boiler and for the adoption of some means of ensuring that the pressure conforming with a proper factor of safety is not exceeded.

While acid was used in the exploded digester at Grand Mere, the internal condition of the vessel after the lining had been removed showed clearly that the acid had never come in contact with the plates, and that it had, therefore, in no way contributed to the accident. The possibility of the acid finding its way through defects in the lining, with the result that the sheet itself may be become so seriously corroded as to materially weaken the strength of the entire structure and perhaps even render it unsafe to operate, should not be overlooked. It should be remembered that the acid is very rapid in its action, and that a slight leak on the exterior surface of the shell by no means indicates that the harm done to the interior surface by the acid coming in contact with it is equally slight. Wherever there is evidence on the outside of the shell of the acid having penetrated the lining, steps should be taken as soon as possible to ascertain to what extent the internal surface of the shell is affected. In some continental countries, the removal of the entire lining of a digester and an internal examination of the shell at fixed intervals is compulsory by law, and such a step, in spite of the cost it may entail, is de-

FIG. 3. THE WRECKED DIGESTER BUILDINGS AND THE DAMAGE WROUGHT IN ITS VICINITY.

serving of serious consideration. It is only by such an examination that the strength of the vessel from time to time and the pressure at which it is safe to operate it, can be accurately ascertained.

We are informed that the Boiler Inspection and Insurance Co., Continental Life Building, Toronto, whose experience in questions relating to the construction and operation of digesters and other vessels operated under steam pressure, extends over a period of nearly 40 years, are prepared to recommend means by which the discovery of acid having found its way through the lining may be noted speedily, and its action upon the plates checked, so that the heavy expenditure entailed in removing the entire lining may be avoided until it clearly becomes necessary.

FRICTION AND LUBRICATION.

By Joseph W. Hayward, M.Sc.

THERE is a good deal of vagueness existent in many people's minds upon the closely related subjects of friction and lubrication. This is because they overlook the fundamental difference in the nature of the friction

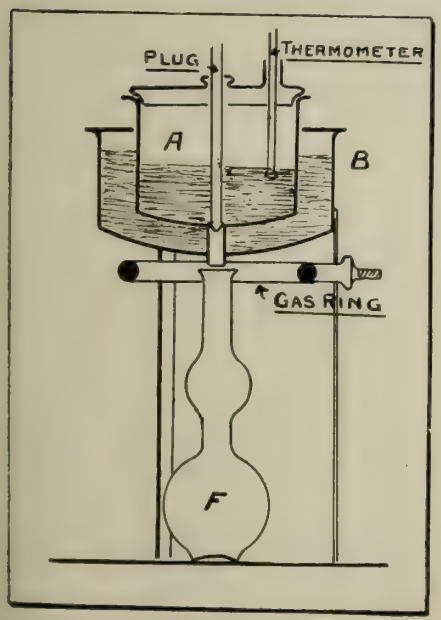


FIG. 6. ENGLER'S VISCOMETER.

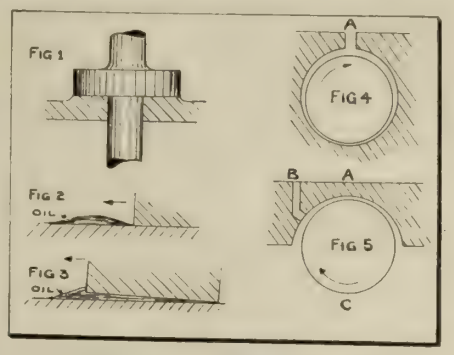
between unlubricated and lubricated surfaces. A moment's consideration will show that the resistance in the two cases is due to conditions as different as chalk from cheese.

It is well known that the resistance to motion between dry surfaces depends upon:

(1) The total pressure between the surfaces. This, however, is slightly pressures, provided always that the pressures than for small areas and great pressures, provided always that the pressure is not great enough to indent or otherwise destroy either surface.

(2) The speed at which one surface moves over the other. Except at very low speeds, the resistance decreases as the velocity increases.

(3) The nature of the surfaces. Relations 1 and 2 hold good for clean, solid surfaces only, but they may be applied to surfaces "filled" with a so-called solid lubricant such as graphite or mica,



FIGS. 1 TO 5. FRICTION AND LUBRICATION.

or with a film of grease so thin that it acts like a solid coating.

In the power house we have little to do with dry friction, except to take advantage of it in rope and belt transmission and in friction clutches. In these cases the object is to provide sufficient resistance to prevent relative motion altogether. Where there is a relative motion, as in all parts of our running machinery, complete lubrication should, and in many cases can be, obtained. By complete lubrication is meant a separation of the solid surfaces by a continuous film of oil, which, however, may be thinner than a thin sheet of paper if the surfaces themselves are correspondingly smooth and accurately finished. Wear of moving parts may be entirely prevented by complete lubrication with a good, clean lubricant, for their metallic surfaces will never come into actual contact with one another.

Friction Between Lubricated Surfaces.

The friction between lubricated surfaces is, naturally, not directly dependent upon the nature of the surfaces, since it is assumed that they do not touch, nor does the resistance vary with the pressure. The latter statement is borne out by the familiar fact that the frictional losses in a steam engine are nearly the same at full and at light loads—i.e., an engine that indicates 100 h.p. and gives 100—20=80 effective horse-power, at full load, will still indicate 30 h.p. when the effective horse-power is only 10. Another difference is that with lubrication friction increases with the speed instead of diminishing. The increase is most marked at moderate speeds.

Forced Lubrication .

The most satisfactory way of insuring proper lubrication is by the use of a pump to force the lubricant between the surfaces to be separated. In certain cases, such as the heavily loaded collar bearing sketched in fig. 1, a force pump must be used. In other cases the tenacity with which oil clings to a surface which it has once covered, and its viscosity or resistance to rapid flow, may be relied upon to keep the metal faces apart. For example, fig. 2 shows a fresh drop of oil upon a guide bar. When the crosshead reaches this, as shown in fig. 3, time does not allow of the oil being swept off completely, an enormous pressure being necessary to do this. The only alternative is for the moving face to rise and pass over a bed of the lubricant, and it is easy to see that the thickness of this bed will depend upon:

(a) The speed at which the crosshead moves.

(b) The pressure between the surfaces.

(c) The viscosity of the oil.

The resistance to motion or friction increases with the viscosity of the oil used. Therefore, it follows that as thin an oil should be used as will maintain a sufficient separation of the surfaces at the speed and maximum pressure to be provided for.

Fig. 4 shows a loaded shaft resting in a bearing, the difference in diameter between the two being much exaggerated. A drop of oil falling on the shaft at A will be drawn round with it to the point of greatest pressure at B, and will separate the surfaces there.

Fig. 5 shows a loaded bearing resting on a shaft. In this case the only way

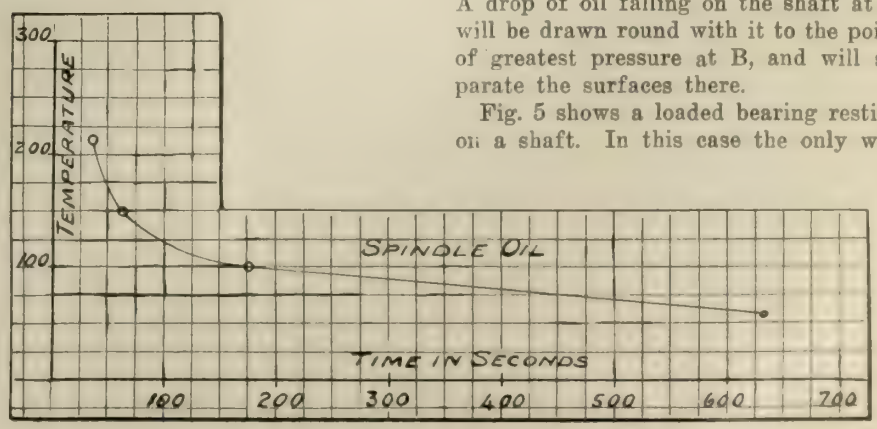


FIG. 7. FRICTION AND LUBRICATION.

to supply oil at A would be to force it in under pressure, but it might be dropped from a lubricator upon the moving surface at B, or rubbed upon it by a saturated pad at C, the latter being the method used for lubricating railroad axles. From the foregoing the importance of using a lubricant of the right viscosity will be understood.

Viscosity of Oils.

The viscosity of all oils changes with temperature, and the temperature of a bearing, except where it is cooled by water circulation, depends upon the frictional losses within it, and these again are proportional to the viscosity of the lubricant; hence it is useless to make a dogmatic statement about the correct oil to be used. This is a matter of experience. The viscosity of some oils is reduced by heat far more rapidly than that of others. Thus, of two oils equally thick at atmospheric temperature, one may remain a useful lubricant and the other be little better than water at the temperature of a steam engine cylinder.

The comparison of viscosities at various temperatures is a simple experiment which any engineer can carry out for himself with an inexpensive apparatus called a viscometer, a sketch of which is shown in fig. 6. An inner chamber (A) is enclosed on a vessel (B) filled with water or oil. This is heated by a gas burner to any desired degree. There is a small hole in the bottom of chamber (A), closed by a plug. The chamber (A) is filled to the level of a mark upon the side with a sample of the oil to be tested. When the temperature of the sample has become steady, the plug is removed, and the time taken to fill a measured portion of a flask (F), placed beneath the orifice, is noted. This is taken as a measure of the viscosity of the sample. The time of passage of the same quantity of clean water at atmospheric temperature may be taken as a standard of comparison, and the test should be made from time to time to check any alteration in the orifice. It is important that the vessel and orifice should be thoroughly cleaned with alcohol and dried before introducing a sample of different oil.

When testing an oil at various temperatures, it is convenient to record the results graphically, as shown in fig. 7.

LARGE GAS ENGINES.

IN the first of his lectures, entitled "Recent Research in the Gas Engine," which he delivered before the Royal Institution, Professor Bertram Hopkinson said that the great obstacle which lay in the way of the development of the large gas engine was the problem of cooling. The trouble is not so much that heat is abstracted from the gas by the cooling water, or that when the diameter of the cylinder is above 23 ins. provision must be made for cooling the piston, but that a widely differing temperature is existent between the opposite sides of the cylinder wall, resulting in severe stresses. It was formerly supposed that the heat from the gas was transferred by means of conduction and convexion, but more recent experiments, made by putting a flourite window in a gas cylinder and placing a bolometer for measuring radiant heat in line with it, show that the transference is actually made by means of radiation. The solution of this difficulty, therefore, lies in the direction of "bottling up" the heat thus radiated, and with this end in view, if the inside of the cylinder be brightly polished, the walls will radiate the heat back to the gas.

LEATHER BELT DATA.

AT a recent meeting of the Birmingham Association of Mechanical Engineers, Mr. R. Berry stated that after a long experience with leather belt drives he had found a good all-round rule, and one easily remembered for belt calculations, to be that 1 ft. per minute of belt speed per inch of width of belt is safely equal to the transmission of 1 watt of electrical energy. If we, therefore, multiply the band speed in feet per minute by the width in inches, the result will be the total energy in watts, and if we divide the result by 1,000, the energy is obtained in kilowatts, which energy the band may be relied upon to transmit without any undue tension being brought upon any part of the belt or excessive friction in any part of the machinery. These data, however, only apply to single leather belting or to woven belting of a similar thickness. If a light double band be employed, then 25 per cent. more energy may be calculated upon; or for heavy double leather belting as much as 60 per cent. more may be added.

The great advantage claimed for this method of calculation is that it fixes a constant for working tensions, so that the working tension becomes directly proportional to the width in inches, this constant being 44.24 lb. pull per inch width of belt. If we wish, therefore, to know the difference in pounds pull on the tight and on the slack side of any belt, all that is necessary is to divide the total output of the machine in watts by the velocity of the belt in feet per minute, and multiply the result by 44.24, and the product will be the extra pull in pounds on the tight over the slack side.

POWER SITES IN BRITISH COLUMBIA.

BRITISH Columbia is rich in waterpowers. Most of the rivers are mountain streams, and consequently possess the advantages and disadvantages for power purposes that usually characterize such. Many of them, near their sources, are torrents subject to wide variation in flow. The generally rocky nature of the mountain riverbeds renders the construction of dams a comparatively simple matter, but the wide variation in the stream flow makes either natural or artificial storage basins a necessity, in order to utilize to advantage the potential energies of these rivers. As the hot sun of summer melts the glaciers and thus creates a heavier run off, many mountain streams are always at their maximum flow during the summer months.

Potentialties of Quesnel River.

Keeping in mind these conditions, it is of interest to consider specifically some of the streams, the power-sites on which have been examined with a view to their possible development. One of these is the Quesnel river, a tributary of the Fraser. At its junction with the latter river, the Quesnel flows through a deeply cut channel. The river valley in general passes through a district composed of gravelly foot-hills, thinly timbered with birch, poplar and other small growth, the whole watershed having been swept by a forest fire years ago. The river is comparatively short for the volume of water it carries, and it divides into two branches some seven miles from its sources; the north branch taking its rise in Cariboo lake, and the south, which is much larger, in Quesnel lake.

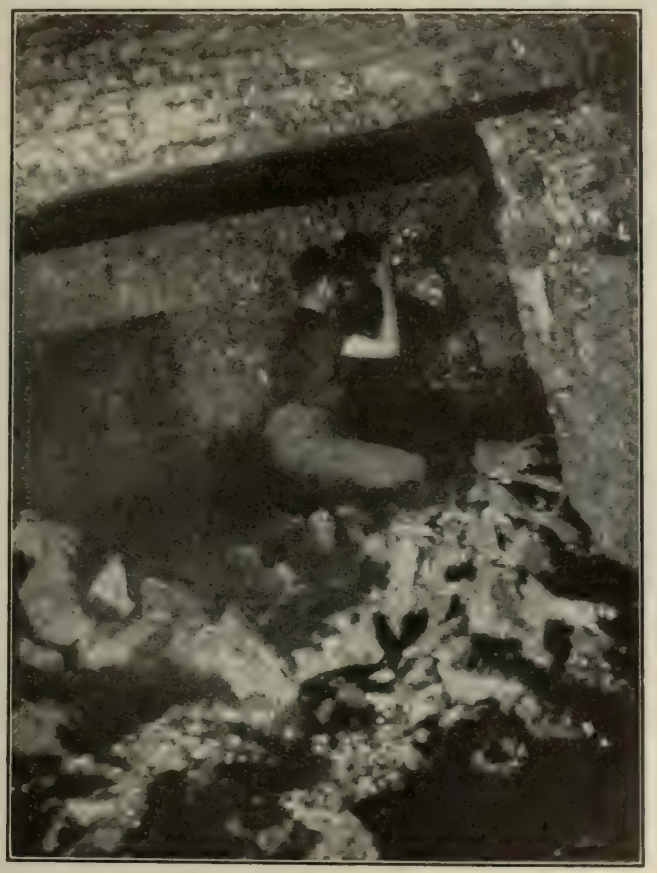
The South branch passes through two rocky canyons which present excellent opportunities for power development. The upper canyon, about an eighth of a mile in length, is at the foot of a series of rapids which reach almost to the lake, nearly three miles above. It is about 300 feet deep and has precipitous and rocky banks, making the construction of power development works comparatively easy A 30-foot dam combined with the present available head of 150 feet.

Three miles lower down is a second and similiar canyon, about one-quarter of a mile long, its physical features corresponding in general to the upper. A feature that makes the South branch of the Quesnel remarkable as a waterpower project, is the dam at the outlet of Quesnel lake. This dam was constructed for mining purposes at a cost, it has been stated, of $400,000, and is of material assistance in improving the storage and regulation facilities of the lake.

The Coal Resources of the Dominion an Empire Asset

In these days when so much attention is being directed to the possibilities of oil fuel in its varied applications, it may not be amiss to point out the prominent place that coal mining fills in Canada's industrial development, and to have brought home to us some facts and figures concerning same.

OUTSIDE the United Kingdom the nearest Imperial source from which fuel can be secured is Canada, and the nearest portion of it in which extensive coalfields exist is Nova Scotia. All the discovered coal measures of the province are adjacent to the coast, and those who are acquainted with the mineral resources describe the supply as inexhaustible. Twenty years ago, Nova Scotia's annual production of coal was about 1,000,000 tons, a figure which five years later had increased by 50 per cent., and within a decade by 100 per cent. In 1911 the output aggregated 6,994,000 tons, valued at about $14,050,000, the increase in production as compared with 1910 being 600,000 tons. The industry gives employment to some 12,000 persons, whose annual wages bill amounts to $7,500,000.



COAL HEWER AT WORK IN A CAPE BRETON MINE.

The largest colliery undertaking in the province is the Dominion Coal Co., who have seventeen collieries in operation and three more which will, before long, be adding their quota to the Company's aggregate output. They raise at present 4,000,000 tons annually. Second in the list of producers are the Nova Scotia Steel and Coal Co., the other big concerns being the Acadia Coal Co., the Inverness Railway and Coal Co., and the Maritime Coal Co. The Dominion Coal Co. produce a steam coal of good quality and do a large bunkering business, besides shipping coal to such far-distant markets as Mexico, South Africa, and the West Indies.

Eastern Coal Deposits.

The tendency in Nova Scotia is towards the extinction of the small coal-owner. Two decades ago the number of companies engaged in the industry was twenty; to-day there are under a dozen, and only six of these are operating on a really large scale. The coal deposits may be divided into four divisions. There is, first of all, the Cumberland coalfield, situated on the Bay of Fundy, where, however, the cost of mining is rather high owing to the disturbed conditions of the coal measures. The same remarks apply to the Pictou and Inverness districts, and in the case of the latter, the difficulties are somewhat increased owing to the necessity for carrying the workings under the Gulf of St. Lawrence. Inverness coal is, for the most part, of fairly good quality, but the lack of adequate and ice-free harbors involves long haulage of the coal—in some cases all the year round—to the Straits of Canso.

Nova Scotia's richest store of coal is contained in the Sydney field, in which it is estimated that there lie some 9,000,000,000 tons. The area extends for about 32 miles along the coast, runs about 8 miles inland, and can, it is believed, be penetrated for miles under the sea. The measures are dry and free from gas, while the easy incline at which, for the most part, the coal lies, added to the contiguity of good harbors, have combined to create an industry of important dimensions. During 1911 the Dominion Coal Company alone shipped 1,450,000 tons to St. Lawrence ports, they having a fleet of steamers which carry a large proportion of the total production during the open season of navigation.

Western Coal Fields.

Taking the Dominion as a whole, the total annual coal production is in the neighborhood of 13,000,000 tons, this figure comprising sales and shipments, colliery consumption and the fuel used for making coke. Crossing the Dominion towards the Pacific coast there are coal measures of minor importance in New Brunswick, but no seams of any magnitude are found until we reach Manitoba. The coal-bearing area of this province extends for about 15,000 square miles; while the neighboring Province of Alberta contains something like 85,000,000,000 tons—lignite, bituminous and anthracite. Little of this could be of much service to the Mother Country, in view of the long rail haul to the coast, but it is, nevertheless, interesting to learn that in the opinion of an eminent authority on the mineral resources of Canada, the richness of the Alberta measures renders it highly probable that in course of time the province will become one of the greatest coal-mining centres, not only in the British Empire, but in the world.

In the year 1910, the daily output of the Alberta mines, of which there are about 150, large and small, in operation, was about 18,000 tons; in other words, the annual production was nearly 3,000,000 tons, an increase of 59 per cent., compared with the figures for 1907. The total production of the Dominion in 1910 was almost equally divided between the eastern and western coalfields, and Alberta contributes about 22 per cent. of the whole, as against 5 per cent. ten years previously.

In British Columbia a coal of better quality is produced, there being several rich seams of excellent anthracite. In 1910, the coal output of British Columbia reached a total of 2,800,046 tons, of the

NOVA SCOTIA STEEL & COAL CO. COAL AND ORE PIERS AT NORTH SYDNEY, C.B.

value of $9,800,161, which figures constitute the highest ever recorded in the history of coal-mining in the province. The greater proportion of the output—about 79.3 per cent., in fact—came from the collieries owned by three companies—the Canadian Collieries (Dunsmuir), Ltd.; the Western Fuel Co., on Vancouver Island; and the Crow's Nest Pass Coal Co., in the East Kootenay or Rocky Mountain district, which, by the way, exports something like 80 per cent. of its production to the United States.

Mr. W. F. Robertson, the mineralogist of the Province, states in the annual report on the mining industry of British Columbia that the demand for export coal, especially on the seaboard, has been so constant and the price obtainable so satisfactory to the shippers that it has permitted of the domestic price being maintained at a figure which enables Californian fuel-oil exporters to compete for the fuel requirements of those railways and steamships which burn liquid fuel. "The maintenance of the present high price of coal on the seaboard in face of the direct competition of fuel-oil both in British Columbia and Pacific Coast of the United States, and the fact that the British Columbia collieries have greatly increased their output, would," he says, "seem to indicate that the market is growing faster than the collieries are being developed, and that the present price of coal is likely to be maintained, a consoling thought to the mineowners, if not to the consumer."

In spite of the operations of the various colliery companies the coal measures of the province have as yet hardly been scratched. Many fields of proved value, though they have been partly developed, have not contributed a ton of coal to the market, largely because the demand is at present fully supplied. Lack of transportation facilities is another obstacle, albeit this can, and doubtless soon will, be remedied. Hundreds of millions of tons of coal are lying ready for the hewer, and a very considerable prportion of this hidden wealth is situated adjacent to the Pacific Coast, both on the mainland and on Vancouver Island. In the valley of the Skeena river there exist extensive beds of anthracite, the output from which could be brought to tidewater at comparatively moderate cost. The coal industry of the Dominion is making steady progress, although the report on mineral production issued by the Department of Mines, show a slight decline in 1911.

The bunkering facilities provided by the port of St. John, New Brunswick, may prove of interest, seeing that geographically it is very favorably situated for vessels engaged in the North Atlantic trade. No other Canadian Atlantic port can compete with St. John in point of cheapness, for there is no reason why coal from the adjacent Queen's County field should not be brought down the river for at least seven months in the year at a cost of from 16 to 20 cents per ton, as against a dollar a ton in the case of the Cape Breton coal generally used in the port. Moreover, the price of the latter is enhanced by unnecessary handling, which also means breakage. Queen's County coal has been employed with satisfactory results by at least one British steamship company engaged in the Canadian trade.

From the foregoing it will be noted that we have not only the resources for more than immediate future contingencies, but the port facilities and ready markets in addition.

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LOADING CAPE BRETON COAL.

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THE DESIGNER'S RELATION TO HIS COMPLETED WORK.

IN the layout of manufacturing and power plants, considerable pains are usually taken to secure the services of an expert conversant with the particular nature of the scheme. Betimes, and perhaps more often than conducive to the best results, the factory staff perform the work, in which case, a more or less affected superiority of intelligence over that of any expert is generally given opportunity of parade. This latter feature is referred to at this juncture because of its connection with, and the possible advantage it confers, relative to our subject.

We are right in saying that when outside help in the nature of an expert to lay out a plant is called in, and when the work is completed, it may be reckoned as his masterpiece, at least to the extent to which his freedom of action and his command of expenditure—legitimate, of course, has been determined. His interest in the work, however, ceases with the payment of his fee, a more or less unfortunate circumstance, as it appears to us. Let us say at once that we are not touting for the opening up of a new field of employment for consulting engineers or architects; it being our purpose rather to draw attention to an equally mutual advantage likely to accrue, were the individual or company responsible for the professional work, retained to supervise and oversee the equipment during a stated period of operation. Although, as we have said, the finished layout may be described as a masterpiece, it needs no stretch of imagination, to form an opinion that even previous to the plant going into regular operation, a large number of improvements begin to suggest themselves. Such being the case, we would naturally look for a further list of failings to show when the wheels begin to go round, or when the handling and transportation of a particular product in process of manufacture comes to be scrutinized with the microscopic investigation of efficiency. At this stage the designer is usually no longer in the employ of the proprietors of the plant, and, perhaps, as a consequence of some unfortunately aggravated trouble having developed in operation, more or less strained relationship exists. In either circumstance, and on both sides, there is loss besides that of prestige, so far as the expert is concerned, and loss of time or product so far as the manufacturer is interested. Were it the rule that an engineer, engaged to design and lay out a plant, had the opportunity to continue to oversee his handiwork, there would not only be less dissatisfaction with services rendered, but on the contrary, a large degree of enhancement given to the profession for future application, if not in the same plant or the same company's plant otherwhere, at any rate on the equipment of others projected.

Plants laid out by the staff of the proprietor are as a rule not only more costly, but generally less satisfactory in operation results than those handled by a man who makes the particular feature his specialty. This condition of things is largely due to the plethora of advice, and the opportunity afforded individual employes to put forward some more or less useless and harebrained idea and have it adopted, simply because they happen to have more authority than knowledge or intelligence. We do not presume to say that ideas put forward by those directing or operating a plant are all and always valueless, but we do say that the great majority of them come under this category, and while their sponsors are perfectly justified in having them put forward, we maintain that, in the circumstance of an expert being employed, no undue pressure should be exerted to have him incorporate suggestions so given, against his own better judgment.

The Future Prime Mover, Will It Be Turbine or Motor?

The author of this paper is one of the world's foremost electrical and mechanical engineers, and his discussion of the merits of the turbine, the internal combustion engine, the internal combustion engine, the electric motor, etc., is such as to appeal to the reader as being reasonable and sound.

MR. S. Z. Ferranti, the well-known engineer, delivered an extremely interesting paper before the Greenock Philosophical Society recently on the question of turbine versus motor, and under the heading of prime movers. In the course of his paper, Mr. Ferranti said:—James Watt was practically the inventor of what we knew as prime movers, and the subject of the lecture was the most interesting problem in engineering. Besides inventing and developing the modern steam engine, Watt had turned his attention to the question of applying steam to motive purposes on what he called a "steam wheel," so getting direct rotary motion.

The work of Sir Charles Parsons in the invention and development of the rotary principle to the production of motive power by means of steam must ever be remembered as a great advance in the development of prime movers. The turbine, notwithstanding its very low efficiency as first constructed, was gradually improved until high mechanical efficiencies of conversion were reached. Before the turbine had been developed, however, another idea had been pursued with a view to simplifying the process of power generation and at the same time getting a higher economy.

The Gas Engine.

Years ago an engine was invented and built by Lenoir, in which a charge of air and gas was sucked into the cylinder at atmospheric pressure and exploded. The piston speed in this engine was low, the ratio of expansion was low, and the economy was very poor. Still, it was a step in the direction of higher economy, inasmuch as by this system a higher temperature of working fluid was obtainable. Later Otto and Langen invented a gas engine in which a flying piston was used, driven upwards by the explosion of a mixture of gas and air introduced into the cylinder without compression. The pressure of the atmosphere, aided by the weight of the piston, pressed the piston downwards, and, through an ingenious clutch and a rack and pinion, it gave rotary motion to the fly-wheel. The next move forward was that of compressing the charge of explosive mixture before firing, and so obtaining a high maximum temperature, a good ratio of expansion, and consequently much improved economy.

Engines of this type belonged to a class of prime movers with "high negative work." In this form of engine the positive work of the explosion had to have deducted from it not only the friction of the engine, but also the amount of work required to compress the charge which constituted the negative work of the cycle. There was a further deduction—that of the friction of the engine or of a separate pump while doing negative work. These deductions would render this class of motor useless were it not for the high mechanical efficiency of the parts used for carrying out the cycle. In the gas engine the negative work was high, but not so high as to form a serious difficulty.

The Diesel Engine.

In the more economical Diesel engine, in which very high pressures were used so as to get a high enough temperature to burn the oil as it sprayed into the cylinder and give a high ratio of expansion, the negative work was a much more serious difficulty—so serious, in fact, in the first Diesel engine that it required more power to overcome the friction and negative work than the engine was capable of giving, so that it would not even drive itself, much less was it capable of doing any useful work. The cycle of the engine was modified, therefore, in the direction of making it less perfect theoretically, and so enabling the engine to become the success which it now was.

No General Monopoly.

The internal-combustion engine and the steam turbine were now competing for premier place in furnishing the world's power. The turbine, though less economical in actual fuel consumption, had many great advantages, and for large powers it was practically unassailable. For small powers it was naturally uneconomical. It seemed to be clear that for small powers the internal-combustion reciprocating engine was in every way the best. At the other end of the scale the turbine was the only means of filling requirements to-day. In between these two extremes there was a doubtful dividing line, where either form of engine might serve the purpose, according to the conditions of each particular case.

As the turbine became larger, so it was easier to construct, and it also became more economical. As the gas or oil engine became larger the natural difficulties increased. On the other hand, as the turbine was reduced in power its economy fell off badly, and it was difficult to make of satisfactory design, while the internal-combustion engine became a most satisfactory and economical machine in small sizes. He thought that this division of the means of power production by large and small units between the rotary and reciprocating machine was almost a natural law, and that those who sought to evade it must either invent some new principle or court endless trouble, expense and failure.

To-day, however, with a complete disregard of these principles the advocates of the Diesel engine were spending vast sums of money on its development. Even this usually all-powerful force might not prove enough to make a wrong principle right. They were told of the wonderful successes of large oil engines in Germany and elsewhere, but few people had any conception of the failures and breakdowns which had occurred, and which were occurring repeatedly with the large experimental engines which had been constructed. In Germany especially, where so much had been done in this direction, they carefully avoided informing the foreigner on these points. It was well known, of course, that the higher the temperature of the working fluid the higher was the economy that could be obtained. High temperatures have proved, however, very difficult to work with. As an example of this the low working temperatures of turbines for marine propulsion might be pointed out.

Ferranti Turbine.

Seeing that the difficulties were mechanical and that great advantages could be obtained if these troubles were overcome, he commenced experimenting some years ago, and had now, after many failures and the expenditure of much money and time, produced a turbine which, at the highest temperatures and with great and rapid variations of temperature, was quite free from mechanical troubles. Indeed, he believed that this turbine was perhaps the strongest from a mechanical point of view that had yet been produced. Moreover, contrary to what might have been expected with a high temperature machine, it ran with certainty with a blade

end clearance so small that it was almost negligible from the point of view of leakage loss, and the fear of the possibility of stripping appeared to have been effectively removed.

In this turbine he superheated the steam initially, and after the first expansion, and while it was still superheated, he resuperheated it before it did its work in the second stage of the turbine. After this it was exhausted in a superheated condition through a regenerator to the condenser. Although the turbine was of the reaction type, no balance dummy was used. The whole of the end load was taken on a specially constructed thrust, thus saving steam leakage. The steam was worked as a gas at high temperature throughout the turbine, and this, coupled with the many improvements referred to, had given very good results. The 5,000 h.-p. machine, which had now been running some time, when tested at a load of two-thirds full power, had given a shaft h.p. on 7 lbs. of steam.

It appeared that when this turbine was run at full load under favorable conditions it would take less than 6 lbs. of steam per shaft horse-power, and that the system, under the conditions named, would have a thermal efficiency of over 24 per cent., corresponding to an oil consumption of about .55 lb. of oil per shaft horse-power. So far as he could see, this system, when applied on a large scale, would be capable of giving an over-all thermal efficiency of 29 per cent. With a high temperature steam turbine of large size generating electricity for all purposes on land, they had the advantage of a machine of the highest efficiency which was not limited to oil for its fuel. It was probable that as improvements were made, the whole of the coal used for firing these large units would be gasified, and the by-products recovered. The great problem for this country was to so utilize the coal as to make it fill their every requirement.

The Electric Motor.

The electric motor which gave its power in a rotary form, and which was supplied from very large power stations was displacing all forms of large power engines. It was probable, therefore, that in future, small prime movers would be required to propel cars and boats, and that all stationary motors would be electric. Reciprocating engines would be used no doubt for a long time, but they could only be regarded as makeshifts, and as soon as an equally efficient machine for any particular purpose was developed it would displace the reciprocating motor. It was difficult to predict the form of the prime mover of the future, but in search of the highest economy, and with the limitations of temperature imposed by known materials, one was inclined to look to electricity, converting the energy of the fuel at low temperature and giving its power in rotary form, as the most likely eventual solution.

INTERNAL COMBUSTION ENGINES.

REFERENCE is here made to the comparative costs of installing and working various prime movers for the generation of electricity, and to recent developments in the design of internal combustion engines.

In the case of an extension to a steam plant, where there were existing boilers capable of giving enough steam, a turbo set, with its lower capital cost, would probably prove the most satisfactory expedient, and in the case of a very large installation where space was of prime importance, and particularly where heavy peak loads had to be carried, the turbo scheme must also offer the most satisfactory solution. On the other hand, where a new plant had to be erected, and more especially where coal was expensive and the load fairly steady, the internal combustion engine had many points in its favor.

Comparative Costs.

There was not very much difference between the capital cost of steam, gas, or Diesel engine stations, when all the necessary auxiliaries, buildings, and foundations were taken into consideration. The steam station consisted of boilers with their seatings, flues, and chimney stack, also economizers, superheaters, and feed pumps. The turbo-generator would certainly be much cheaper than the gas or Diesel driven set, but there also must be taken into consideration the necessary condensing plant and high-pressure piping. The gas station would consist of a gas producer plant, gas engine, and generator, water circulating pumps and air compressor for starting purposes, and there would be an engine-house and small shed for covering the boiler and gas producer auxiliaries. The Diesel engine station would cost somewhat more than the steam station; but although the Diesel engine was a comparatively expensive piece of machinery it was complete in itself; the only accessories being a circulating water pump and fuel tanks.

The comparative capital cost for a station of 650 kw., a typical installation for the supply of power to a moderately large works or factory, would be for a turbo-generating plant (including power-house, boiler, turbo-alternator and condenser, switchgear, etc., £8,850; gas engine installation (two engines and generators, gas plant, gas-holder, etc.), £9,640; and Diesel engines (two engines and generators, engine house, etc.), £11,080. Assuming that the station would be worked 3,000 hours a year, the running costs per week, including fuel, labor, oil, waste, stores, repairs, and maintenance, interest, and depreciation, would be—turbo-generator plant, $260; gas engine installation, $218; and Diesel engines, $300. Where gas existed as a by-product, the gas engine had tremendous advantages.

Large and Small Gas Engines.

On the continent of Europe, the development in gas-engine work had been mostly in the horizontal double-acting type of large power, units of 2,000 to 3,000 b.h.p. being common. These engines were built on both the two and the four-cycle principles. The usual arrangement was to put two double-acting cylinders in tandem working on one crank, and for the larger powers, four cylinders on two cranks, with the fly-wheel and generator between the cranks.

There was much to be said in favor of the smaller units, and the following considerations were worthy of notice:

(a) The thermal efficiency of a moderate-sized unit was not less than that of a large unit.

(b) The risk of failure in vital parts in large engines was certainly greater than in small ones.

(c) The capital cost and space occupied by a number of smaller units was very little more than that of a large unit.

(d) A number of units gave a much more "elastic" station and a greater factor of reliability.

From a paper by Mr. K. Cox on "Internal Combustion Engines," read before the Yorkshire section of the Institution of Electrical Engineers recently.

TIGHTENING HAND-HOLE COVERS UNDER STEAM PRESSURE.

A FATAL scalding case due to the blowing off of one of the caps of an economizer at a mill at Liverpool, recorded in Board of Trade Report No. 2,162, illustrates the danger that attends the tightening up of external hand-hole covers under steam pressure. The cap, which was of external oval shape and fitted over an opening of 2¾ in. diameter, was secured by means of two bolts, ⅝-inch diameter, and the joint between the cover and flange was made with packing material about 1-16 inch thick. It appears that as the cap was leaking slightly, the engine attendant proceeded to tighten it up with a 9-inch spanner, and while in the act of doing so the cap was blown off, and the man so seriously scalded that he died a few hours afterwards.

The report states that judging from the appearance of the fracture, the bolt was of good average quality, and given

fair treatment was sufficient for the purpose intended, but it is desirable to point out for the benefit of all boiler attendants that the nut of a ⅝-inch bolt can be easily twisted off with a spanner 9 in. long, and that any attempt to tighten up the caps of economizers while at work is a direct contravention of the makers' specific instructions that under no circumstances should any of the joints be interfered with whilst under pressure. This is by no means the first accident of the kind that has occurred and we trust the publicity given to the occurrence may be the means of preventing their repetition in the future.

PROTECTION OF ALTERNATORS.

THE protection of alternators whilst running in parallel and while synchronizing is an important detail and deserves some consideration. In colliery work continuity of supply of power is the most important matter to be considered, and it is, therefore, essential that in case of bad synchronizing both generators shall not be disconnected from the circuit. This is guarded against by fitting reverse current relays on each generator. These reverse current relays protect either machine from being motored. The relays are set to operate on a small percentage of the full-load current of each machine. They are made on the same principle as an ordinary wattmeter, viz., in case of a reversal of current the instrument also reverses and closes a local circuit, in which the machine circuit breaker is included. It is also essential that time-limit relays should be fixed for each generator. The time limit should depend upon the load. Should an incoming machine be running too fast when switched in, and it snatches all the load, a time limit gives the machines a chance to right themselves before they are cut out.

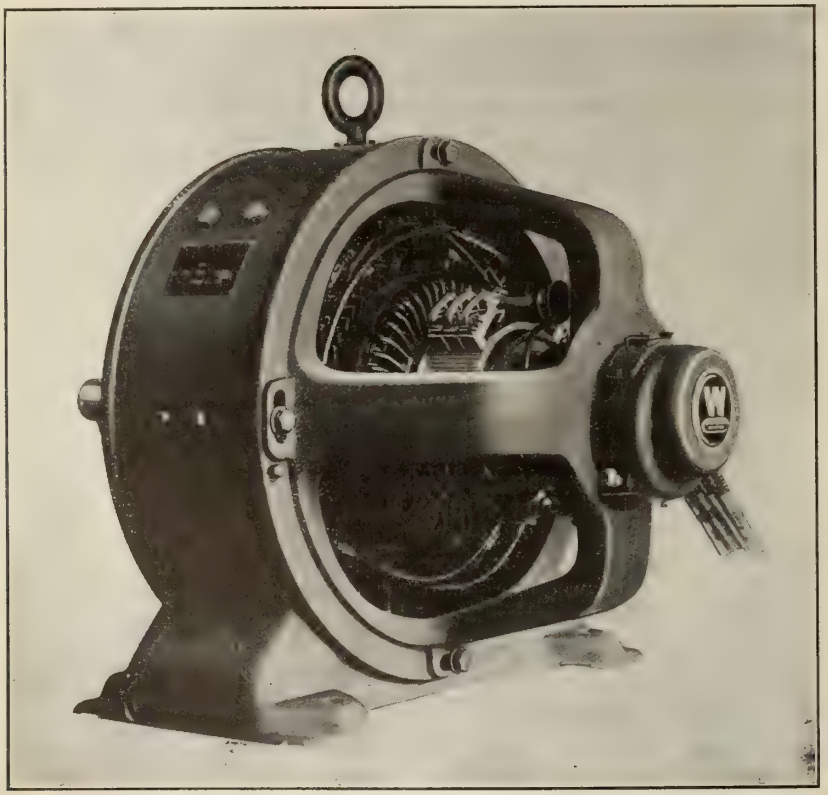
PROCESS FOR BABBITT-LINED BRONZE BEARINGS.

THE Dochler Die Casting Company, Brooklyn, N.Y., have recently brought out a new process of making a babbitt-lined bronze bearing. A mixture is used which is plastic while hot, but hard when cold. In this manner the bronze part is made by taking the heated mixture and forcing it by means of hydraulic pressure into a steel mould. A hard, accurate shape is thus produced ready for lining.

The lining of the shell with babbitt is the novel part of the process. A rolled, sheet babbitt metal of high-grade is used and this is cut into strips to fit into the recess of the bronze part. Hydraulic pressure is then applied and the babbitt metal is forced into the recess and securely locked into position. The recess is dovetailed so that when the shaft revolves in it, in either direction, the babbitt cannot come out.

The bronze shell having been forced into an accurate steel die, needs no machining, and the babbitt shell is likewise accurate on account of the die used to press it into the recess. The finished or completed bearing is, therefore, ready for use. It is used like a die cast bearing, which it really is, and slipped into place without machining or scraping.

Bearings of similar construction have been used for automobile work in France and Italy for the past ten years with excellent results, and after this length of service have been found nearly as good as new. The bronze, of course, stands a strain that a die casting will not, and in addition, the anti-frictional qualities of the babbitt with its ability to adapt itself to the shaft are also obtained.



NEW WESTINGHOUSE MOTOR.

NEW WESTINGHOUSE MOTOR.

A NEW Westinghouse motor, just placed on the market, is especially designed for driving bending rolls, raising the cross rails of planners and boring mills, moving the tail-stocks of large lathes, and similar service requiring motors with special torque characteristics. The special feature is a heavily compound field, most of the excitation being due to the series coils. The torque, therefore, increases rapidly as the current input increases, a necessary characteristic in starting a cross rail or taking a plate through bending rolls. The shunt field winding limits the no-load speed to approximately twice the full load speed so that racing is impossible.

Mechanically, these motors are exceptionally strong. The frame is made of rolled steel, the shaft of axle steel, the bearings large, and dust and oil proof. The commutation is practically sparkless, due to the use of commutating poles and careful design of the commutator and brushes. It is claimed that these machines require very little attension, as lubrication is automatic and the brushes rarely require renewal.

These motors are made in capacities of from 3 to 40 horsepower, for 230 volt direct current circuits by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

August Kastella, chief engineer of the G.T.R. Stratford shops electric power plant, has been appointed engineer in charge of light, heat and power at the G.T.R. Central Station and the Chateau Laurier, Ottawa. Mr. Kastella is secretary of the Canadian Association of Stationary Engineers.

Port Arthur, Ont.—Approval of the plans for the intake pipe and the new water works has been received from the provincial health officer.

THE READERS' POINT OF VIEW

Devoted to brief descriptive article contributions covering ideas and experiences pertaining to power plant practice and operation. We pay for accepted material.

A SUGGESTED MOTOR FEATURE.

By D. A. Hampson.

TO whom has the exterior appearance of an electric motor not appealed? The general smoothness of design, the sweeping curves, the generous fillets are ever a delight to the eye. But what of the man who has to set and align one of them with a shaft possibly at some distance from the motor? Symmetry is quickly forgotten, and in its place comes one great wish—a wish for two flat surfaces, not artistic, perhaps, but bearing a known and accurate relation to the motor shaft.

Of course, the base of the motor may be planed off and the yoke or spider carrying the bearings may bolt to the faced ends of the centre frame, which may be accessible at spots if the paint is scraped off, or the motor may slide on planed rails. Again, the pulley might be removed and the oil cover taken off the other end, exposing the shaft so that measurements could be taken from a plumb line dropped somewhere near.

Who wants, however, to dissect even a ½ h.-p. motor to line it up when suitable spots could be so easily provided by the makers? Why could not two pads be added on top of the frame, as far apart as possible, and faced off? Then a good-sized level could be laid across right in plain sight, and the certain error caused by using a level on a stub shaft would be avoided. Further, the hubs at each end could be turned to the same diameter for a distance of ½-inch, and a line dropped to them, or a cut might be taken along the edge of the feet and planing spots on top of them dressed off.

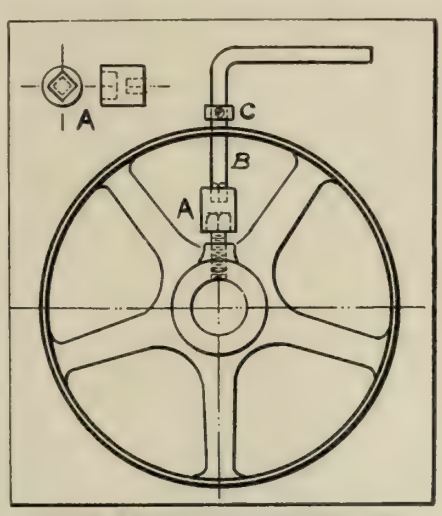
These small improvements would cost little, and would be a real help to millwrights or electricians.

QUICK METHOD FOR PUTTING SET SCREWS IN PULLEYS.

By James E. Cooley.

THE accompanying sketch shows a method for placing set screws in pulleys. The usual plan adopted is to turn them in the hub of the pulley by means of a wrench; but, since the arms of the pulley obstruct the movement of the wrench, the screw must be run in by half-turns.

A bushing (A) is broached out square on both ends, and one end is placed over the head of the screw, which has been started in the hub by hand. The end of



QUICK METHOD OF PUTTING SET SCREWS IN PULLEYS.

the rod (B), which is milled square, is inserted in the bushing by passing throngh the hole in the rim of the pulley, which acts as a guide. A few quick turns of the rod send the screw down to the shaft hole. The collar (C) on the rod acts as a stop for turning the screw down within one or two threads of the shaft hole, the pulley being then ready for assembly on the shaft.

BOILER INSPECTION.

By J. E. N.

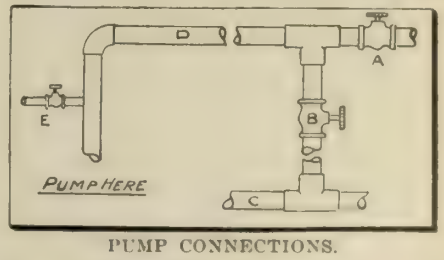
GOVERNMENT inspection of steam boilers is a step in the right direction. It is a forward move towards the protection of property and the lives of the public and boiler room workers. Most of us engineers know that rivet holes should be drilled, not punched, or punched smaller than required and reamed to the proper size, but how many of us know whether as a fact they have been drilled or punched. Punching comes cheaper and perhaps the maker has used this method and even used drift pins. If the holes are not in line, the dishonest maker will not discard the plate, but use the drift pin, thus distorting the holes and making a defective job of the riveting besides leaving the joint weaker and less able to stand the pressure strain.

We engineers know that a boiler plate should have from 55,000 to 60,000 lbs. tensile strength, and that the elastic limit should be between 30,000 and 33,000 pounds, but we are absolutely ignorant, so far as actual knowledge goes, whether the plates in the boilers we are operating conform to these requirements or not. How are we to know whether the right temperature was used when the flanges were turned. If the labor employed in bending the steel plates is not of a high class, an improper job will be done and the flanges may have cracks practically invisible to the eye after the boiler is built. How can we tell if the iron rivets have a tensile strength of 48,000 and the steel ones 55,000 pounds? Do we know anything about their ductility? Government inspection should ease our minds on all these points if the inspection is carried out properly. The reliable and honest boiler manufacturer will welcome such inspection.

PUMP CONNECTIONS.

By James Ellethorn.

A METHOD, not generally known, of connecting a steam pump exhaust pipe is shown in the accompanying illus-



PUMP CONNECTIONS.

tration. The exhaust pipe is shown at (D), the opening (F) leading to the atmosphere. A ¼-inch by-pass from the live steam pipe which runs the pump is

seen at (E). The pipe connecting exhaust pipe (D) to the suction pipe (C) carries the globe valve (B), and the operation of the lay-out is as follows:

Shut valve (A) and open valve (B). Open the by-pass valve (E) for a few seconds, then close (E) and (B) and open (A). This will cause a partial vacuum in the suction pipe (C). By turning on the live steam and starting the pump, the latter will take the water at once. After the pump has run a few minutes, open valve (B) and close (A). The exhaust will then be condensed and pass through the pump. Some engineers will claim that the idea is not feasible, but before they condemn it let them put it to a practical test.

THE C.A.S.E. AND GRADED CERTIFICATES.

By J. A. Robertson*

IN your February issue appears an article on "the C.A.S.E. and graded certificates." After stating that a deputation of the executive of the Canadian Association of Stationary Engineers had again waited on the Minister of Agriculture to press their desire on the subject of graded certificates for operative engineers in the Province of Ontario, the article goes on to say that, "a year has almost elapsed since a like proceeding took place, and if we may judge by the consideration given the request then and now, another year will probably elapse in which nothing will be done in this direction," and so on. It is further stated that "the C.A.S.E. keeps its light too much under a bushel, to make much headway, the executive and the various lodge officials being either too much involved in their own personal affairs like most of us, or not being enough awake to the far-reaching advantages of even a moderate degree of publicity."

As president of the executive of the C.A.S.E., I wish to take exception to the implied charge of neglected duty in not having given more publicity to our proceedings on this important matter, for the executive of this year has, in my opinion, and in that of other members, taken the most effectual course to bring about the desired object, by notifying and obtaining the approval of the subordinate lodges. This we considered to be all that was necessary in the way of publicity. Last year The Power House allowed the executive to be criticized by an anonymous correspondent, and in this way too much publicity was given matters which did not concern anyone outside the C.A.S.E., although greatly pleasing those antagonistic to our views. The impression left, implied that the C.A.S.E. were not united in their demands. This year, after consulting the lodges, united action was taken, resolutions formulated and presented to the Minister of Agriculture in favor of certain changes in the Act respecting stationary engineers, being a simple plea for justice to those engineers who wish to improve their position. There was also presented to the Minister, a petition largely signed by the manufacturers of the province, supporting us in our request for graded certificates. Many more signatures could have been obtained had it not been that we expected to be heard by the Minister about December 20, whereas it was January 29 before we obtained the interview.

We are satisfied that there are influences at work to prevent the much desired legislation and that instead of there not having been sufficient publicity given, there was enough to meet all requirements. Greater publicity would only have resulted in stirring up antagonism from parties who are interested in preventing the passage of the measure. There was no desire on the part of the executive to keep its "light under a bushel."

Besides the executive, there were present at the interview (kindly arranged for us by Mr. James Torrance, M.P.P.), representatives from different lodges of the C.A.S.E. in various parts of the province. The editor of The Power House was invited to be present but was probably "too involved in his own personal affairs" to avail himself of the invitation. The matter has now been fairly placed before the Minister of Agriculture, and whether the legislation be granted or not, the executive will be able to report at the next Annual Convention that they have done all in their power to bring it about, and believe it will meet with the approval of those whom they represent.

I wish to thank all the members of the C.A.S.E. for the loyal support they have given the executive in their efforts to secure this much desired legislation.

*C.A.S.E. Executive President.

C.A.S.E. ANNUAL CONVENTION.

THE 24th Annual Convention of the Canadian Association of Stationary Engineers will be held at Owen Sound, Ont., on July 29, 30, and 31, either in the city hall or in the skating rink; depending on the extent and number of exhibits. The city council at a recent meeting voted a substantial grant to help cover expenses. Arrangements have been made with some of the leading manufacturers for the inspection of their plants during convention week, including the Malleable Iron Works, William Kennedy & Sons, Corbet Foundry and Machine Co., etc. Needless to say, the local Lodge, through its individual members and collectively, is sparing no effort to outstrip all previous conventions, a task worthy of achievement, because of the high standard set.

The executive officers of the Association elected for 1913 were: President, J. A. Robertson, Stratford; vice-president, S. Cosford, London; conductor, F. Chesher, chief engineer of the rolling mills, Belleville; doorkeeper, H. L. Bishop, engineer, Federal Life Building, Hamilton; treasurer, W. E. Archer, engineer, Nasmith's, Toronto; secretary, A. Kastella, engineer in charge of light, heat and power at G.T.R. station and Chateau Laurier, Ottawa, and until recently chief engineer of G.T.R. shops power plant at Stratford; past president, W. Norris, manager of the C. W. & L. Electric Railway, Chatham.

Owen Sound Lodge No. 25 invite all C.A.S.E. lodges to send delegates, and extend an invitation to all engineers from districts where there is no lodge. They wish them to come in and swell the ranks, and to see the exhibits. The Owen Sound officials are: President, Ernest Hooey, and secretary, W. J. Needham.

Among the pleasant things promised visitors to the Convention will be a trip to Balmy Beach, a resort three miles away on the west side of the Sydenham River. For this trip, several city business men have promised the loan of their motor launches.

STEAM AIR JETS IN STEAM BOILERS.

THE use of steam air jets in connection with steam boilers was mentioned in a paper by A. G. Hall, chief smoke inspector of Cincinnati, read before the Cincinnati Railway Club, towards the close of 1912. He conducted a test of a horizontal return tubular plant equipped with steam air jets. A pyrometer was placed in the combustion chamber and one-minute readings were taken. Nine shovelfuls of coal were fired at intervals of about 14 minutes. In each case the temperature rose 100 to 150 deg. Fah. higher with the jets on, than with them off. Also the draught over the fire increased 0.03 in. with the jets on. With the jets on, there was no smoke, and with the jets off, the stack emitted dense smoke for a period of 5.5 minutes after each fresh charge of coal was put on the fire.

Analysis of flue gases was made, with the following results:—With jets on, an average of 11.4 per cent. carbon dioxide, 7 per cent. oxygen, and 0.4 per cent. carbon monoxide was obtained, whereas 4.8 per cent. carbon dioxide, 14.3 per cent. oxygen, and 1.3 per cent. carbon monoxide was shown with the jets off.

PROGRESS IN NEW EQUIPMENT

There is here provided in compact form a monthly compendium of the power plant manufacturers' achievements.

SKEFKO SELF-ALIGNING BALL-BEARING.

THE success which has attended the introduction of the Skefko Self-Aligning Ball Bearing is witness to its practical value, and to the adequacy, in service, of its special features. Although the bearing is novel in its design, it is, none the less, so simple that the whole of its features may be appreciated after a few minutes' inspection of a sample, and there will be no difficulty in understanding its construction from the illustrations. Fig. 1 is a perspective view of a Skefko radial bearing of ordinary type; Fig. 2 a perspective view of a Skefko thrust-bearing, partly disassembled; Fig. 3 a cross-section through half of the radial bearing, and Fig. 4 a section through a combination thrust and radial bearing fitting. Confining our attention for the moment to the ordinary radial Skefko bearing, as shown in Figs. 1 and 3, it will be seen that the arrangement consists of a ridged innner race carrying two rows of balls which work against an outer race, the surface of which forms part of a sphere. The balls are held in position and their pitch is maintained by a solid metal cage, which can be very clearly seen in Fig. 1, and is shown in cross-section in Fig. 3.

Ideas Underlying the Design.

The first main idea underlying the design of the bearing has reference to the fact that the spherical outer race allows the inner race and balls to swivel out of their plane of rotation, so that they are capable of adjusting themselves to any out-alignment of the shaft owing to bending or bad erection. The value of this feature is recognized in ordinary ball-bearings, which are so frequently mounted in swivelling housings, but the advantage of having the feature inherent in the bearings themselves is obvious, more especially as the swivelling, of course, takes place on balls instead of on a solid bearing, so that even in extreme conditions, with a badly bent shaft, or one somewhat light for the work in hand, the loss in friction due to the swivelling is extremely small.

The second idea underlying the design is that, owing to the two rows of balls, the load is at any instant taken on three balls, situated at the apices of a triangle, instead of on a single ball, as in an ordinary bearing. This feature greatly increases the capacity of the Skefko bearing, and renders it capable of dealing successfully with very heavy loads.

A third feature of the bearing which should be mentioned, and which also has relation to the heavy loads which it can carry, turns on the areas of contact between the balls and the races. In an ordinary ball-bearing the areas of contact between the balls and the outer race are greater than those between the balls and the inner race. This is due to the fact that, in the plane of rotation, the outer race is concave towards the balls in contact with it, but the inner race is at the same time convex. The effect of the unequal contact areas is that undue wear takes place on the inner race, and at the same time unequal strains are set up in the balls, leading sometimes to fracture. In the Skefko bearing, however, these unequal areas do not exist, since the radii of curvature of the ridged inner race are taken so that the contact areas with the two races are the same. The radii of the inner race are a little greater than the radii of the balls, although this is not shown very clearly in Fig. 3.

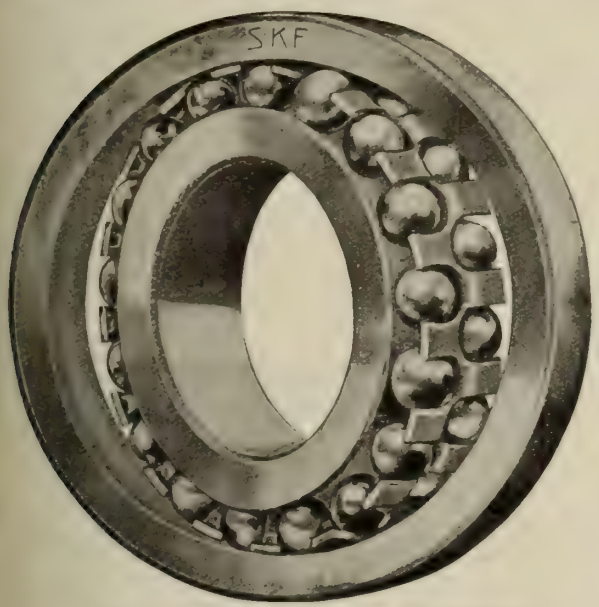


FIG. 1. PERSPECTIVE VIEW OF SKEFKO RADIAL BEARING, ORDINARY TYPE.

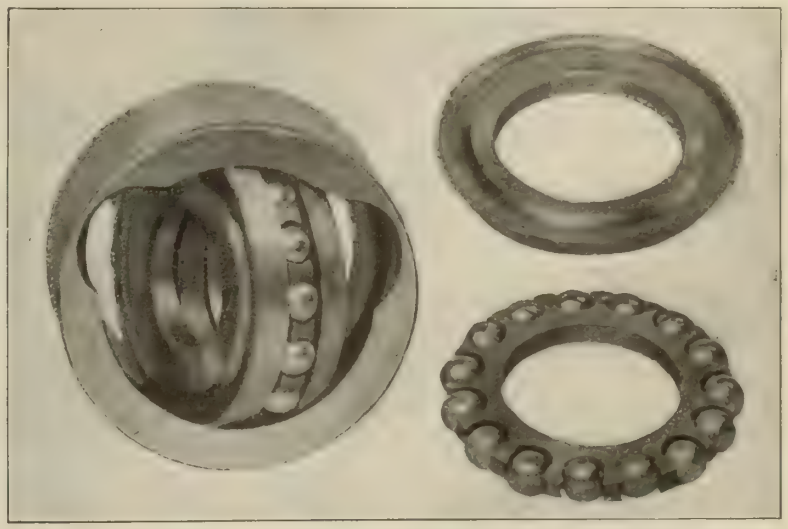


FIG. 2. PERSPECTIVE VIEW OF SKEFKO THRUST BEARING, PARTLY DISASSEMBLED.

Load Carrying Features.

It is probably hardly necessary to refer in further detail to the main features of the bearing, although it is perhaps well to point out that any load on the bearing must be taken equally by the three top balls, as they are at the corners of an equilateral triangle. Also that any such load is transmitted through the centre of the balls directly to the centre of the bearing, since the radius of the outer race is struck from this centre of the bearing. The tangents at the points of contact of any ball with the races are always at right angles to the line joining the centre of the ball to the centre of the bearing, so that there is at no time any outward thrust on the balls due to the load. At the same time, however, the bearing is capable of taking a certain amount of end-thrust, owing to the ridged inner race and the spherical outer one. The inner race and balls are capable of slewing completely round in the outer race, and at the same time maintaining proper contact with it. The example illustrated in Fig. 1 is shown with the balls and inner race moved round through a large angle.

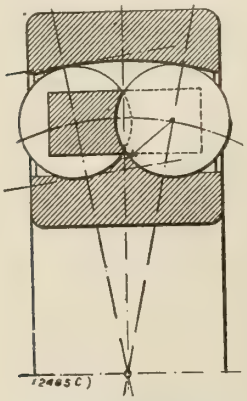


FIG. 3. SECTION THROUGH HALF OF RADIAL BEARING.

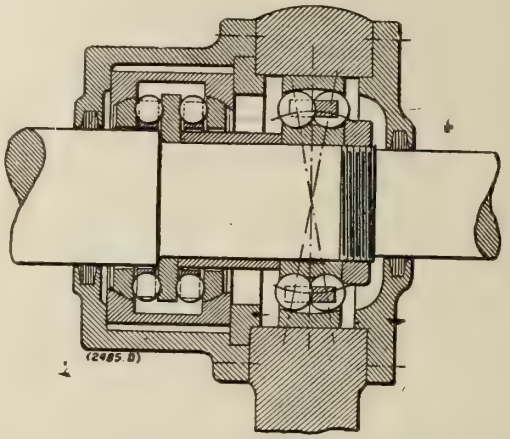


FIG. 4. SECTION THROUGH COMBINATION THRUST AND RADIAL BEARING FITTING.

It is claimed by the makers that Skefko ball-bearings are not only capable of performing very heavy duty as a result of their design, but also in virtue of the material of which they are made and the accuracy of their construction. Both balls and races are made of Swedish charcoal crucible cast steel, the balls being formed by a die-forging process, instead of being turned from a bar, so that they receive much working in course of manufacture and are of quite exceptional strength when completed. The races are turned from bar and hammered blanks, and are hardened and tempered in a special plant before grinding. The grinding is, of course, one of the most important operations in the manufacture of the races. It is done on machines specially designed for the operation, and carrying rotating carborundum wheels at the ends of oscillating arms. The pockets in the cages are proportioned to hold the balls quite loosely, but at the same time, prevent them falling out by their own weight. A race with its balls may be handled as a complete unit, without fear of losing the balls, and, at the same time, any ball may easily be sprung out of place by prising it from behind, if it is desired.

The Skefko Thrust Bearing.

The thrust bearing, shown in Figs. 2 and 4, although not a main feature, is yet of much interest in itself. The bearing shown has a double row of balls, but both double and single-row thrust-bearings are manufactured. The balls are carried in a phosphor-bronze cage, and the races and housing are turned from crucible cast steel and ground. The three races making up the bearings are turned so that their outer surface forms part of a sphere, which is capable of rotating in any direction in the housing to allow for lack of alignment. The disassembling of the bearing is allowed for by two slots made in the housing, which can be seen in Fig. 2. By swinging the races with their balls out of their plane of rotation until one of the end races comes opposite these slots, it is possible to remove this race, and after it, the first set of balls with their cage. The bearing is shown with these two parts removed in Fig. 2. The remaining parts may, of course, be removed in the same way, while individual balls may be sprung out of their cage exactly as in the ordinary bearing previously described.

Skefko Self-Aligning Ball Bearings are of Swedish origin, and manufactured in England. At the recent Toronto Motor Show the Canadian Fairbanks-Morse Co., representatives for Canada of this specialty, had several examples on exhibition.

THE ALLEN SAFETY HOLLOW SET SCREW.

THE Allen safety hollow set screw was designed primarily to eliminate the risk of personal injury which is inseparable from the use of the ordinary square or hexagon-headed set screw. As may be seen from the cut, it is hollow inside, the centre being a hexagonal recess, into which a bent steel bar of corresponding size is introduced as a wrench.

The Allen hollow set screw is made from plain cylindrical stock, and not cupped from a disc. It is highly finished in every way, and is intended fully as much for use in machine construction as for overhead work. It is especially useful for replacing flush-headed screws driven by a screwdriver, the fact being well known that the latter cannot be screwed up really tight. If the screw is of soft steel the slot is liable to burr over, and if the steel is hard, the edges of the slot chip off. It is safe to say that the day is not far distant when the slotted head screw will be a thing of the past in machine construction.

For ordinary purposes the Allen safety hollow set screw is made in two lengths for each size, except in the case of the 9-16in. and ¼in. sizes. The screw generally used has a length equal to its diameter, this being ample for most purposes. For parts subject to much vibration the longer screw is, however, recommended; hence the reason for stocking two lengths. The great strength of the Allen set screw has frequently been demonstrated. We ourselves recently saw one of 1-inch diameter screwed home tight into a blind hole with all the force a mechanic was able to apply at 20 inches leverage, and upon withdrawal it appeared to be in as perfect condition as before the test.

THE ALLEN SAFETY HOLLOW SET SCREW.

The Allen Manufacturing Co., Inc., of Hartford, Conn., hold patents on this set screw in the leading countries of the world. The Canadian market is supplied from a well-appointed factory situated at 29 St. David's Lane, Montreal, where a large stock from ¼in. up to 1in. inclusive is always carried.

Edward Hanson, late of the Montreal Light, Heat & Power Co., has been appointed electrical superintendent of light and power in Saskatoon.

POWER PLANT DEVELOPMENTS

A record of current municipal, manufacturing and general industrial projects, involving steam, gas, oil, electricity, air and water power equipment requirements.

Electrical

Toronto, Ont.—The city council may spend $90,000 on generators to supply $6,000 kilowatts.

Outremont, Que.—It was announced at a recent council meeting that this town will generate its own electricity in the future.

Medicine Hat, Alta.—The government will install an up-to-date telephone service in this city. Building will commence in the spring.

Port Arthur, Ont.—Two new street cars with trailers are required. The city will take 250 h.p. more from the Kaministiquia Power Co.

Sarnia, Ont.—The city's Hydro-Electric line will be extended to Sebringville, to supply that village with power. Power will be generated at the local plant.

Calgary, Alta.—The city council is considering the question of adopting trackless trolley cars or motor buses in the residential districts where tracks are objectionable.

Welland, Ont.—The Ontario Power Co. will sell no more power in Welland than is already contracted for. A hydro-electric line may be built to this city from the Falls or Allanburg.

Calgary, Alta.—Mr. R. A. Ross, who was engaged to advise the council on the best method of obtaining power, has recommended a ten-year agreement with the Calgary power company.

Macleod, Alta.—The Canadian Western Natural Gas Light Heat and Power Co. will supply this town with a minimum of 750,000 feet of gas for its power house, at the same rate as it supplies Calgary.

Toronto, Ont.—The civic car lines on St. Clair Ave. will be set in operation as soon as possible. Works Commissioner Harris will purchase requisite land for car barns, buildings, and will secure the rolling stock necessary.

Montreal, Que.—The Cedar Rapids Power Co. have sold to the Aluminum Co. of America, and the Montreal Light, Heat and Power Co., 80,000 horse-power, leaving 40,000 horse-power to be sold out of the first installation of 120,000 horse-power.

Montreal, Que.—The National Hydro-Electric Co. is making application to the city council for permission to enter the city to sell electric power. It will develop 160,000 horse-power at Carillon Falls, thirty-five miles from Montreal.

Grande Mere, Que.—The H. E. Talbott Co., of the Soo have been awarded the construction of a 1,500-foot dam and the installation of a complete hydro-electric system. The contract involves over $1,500,000, and will employ a thousand men. Over 75,000 h.p. will be developed at the new station.

Water-Works

Kincardine, Ont.—The town council contemplate the purchase of a waterworks pump.

London, Ont.—The council has spent $1,500 for property, on which it will erect a fire station.

St. John, N.B.—Legislation towards extending the water systems beyond the city limits is being sought.

Cowley, Alta.—A waterworks system is contemplated by the council, and a committee is looking into the matter.

Vancouver, B.C.—The city needs a 12-in. water meter to measure water from the Esquimalt Water Works Co., capable of measuring 10,000,000 gallons per day.

Regina, Sask.—The ratepayers recently passed the following by-laws: $825,000 for street railway extensions; $675,000, electric light and power; $200,000 for waterworks purposes.

Steelton, Ont.—A waterworks system will be built to cost $50,000. The work includes the laying of an intake pipe, erection of pumping station, machinery, etc. Town engineer, W. B. Redfern.

Refrigeration

Westmount, Que.—The Ice Manufacturing Co., have been granted permission to build a plant on Bethune Street.

Kingston, Ont.—The Kingston Rink Co. are preparing to build an ice-making plant in connection with their skating rink.

Nelson, B.C.—The Lucia Meat Co. is having its market equipped with a 3-ton "Alaskan" refrigerating plant by the Armstrong Machinery Co., Spokane, Wash.

Toronto, Ont.—Tenders have been called for the 100-ton ice plant by the ice dealers of this city, the estimated cost of which, including the building, will be $100,000.

Winnipeg, Man.—The Winnipeg Consumers Ice Co. are erecting a complete 50-ton electrically operated ice-making plant, machinery being furnished by the Arctic Ice Machine Co., Canton, O.

Penticton, B.C.—The H. & R. Trading Co. are installing a 25-ton ice-making and refrigerating plant at their store. Machinery was furnished by the Triumph Ice Machine Co., Cincinnati, O.

Montreal, Que.—It is reported that the Consolidated Milk Co., of which Neil Sangster of Ormstown, Que., is president, will build a creamery, cold storage warehouse and refrigerating plant to cost about $250,000.

Montreal, Que.—There is a renewed talk of a new skating and hockey arena with artificial ice. There is a scarcity of playing ice at present, and on this account some of the rinks charge exorbitant terms to some of the smaller hockey clubs.

Ottawa, Ont.—The House of Commons is figuring on the installation of a heating, ventilating and air conditioning plant for the House, a plant that will maintain an even temperature

and humidity, changing the air within stated periods, regardless of outside temperature.

Toronto, Ont.—The Ice Manufacturing Co., Ltd., have purchased a site in the north east section of the city, along the C.P.R. main line to Montreal, and will build an ice factory of 200 tons daily capacity, and ice storage of 50,000 tons capacity. A smaller plant will be built in the east end of the city.

Toronto, Ont.—Construction will begin soon on the Toronto Municipal Abattoir, where facilities will be provided for private butchers, or meat dealers to do their slaughtering. There will be three buildings; the abattoir proper, a rendering plant, and a power house. Refrigerating machinery will be installed.

Sault Ste. Marie, Ont.—The Soo Falls Brewing Co. will add to the refrigerating plant in its brewery, a 65-ton "Safety" ammonia compressor, contract for which including also a heavy duty Corliss engine, ammonia condensers, etc., was let to The Huetteman & Cramer Co., Detroit, Mich.

Sault Ste. Marie, Ont.—The Algoma Produce Co. have purchased an 18-ton "Safety," motor-driven refrigerating machine, also high pressure side and expansion system for cooling 50,000 cubic feet of cold storage space. The machinery and equipment is being supplied and installed by the Huetteman & Cramer Co., Detroit, Mich.

Toronto, Ont.—The Crystal Ice-Makers, Ltd., has been organized with a share capital of $300,000. The company has secured a site on the waterfront, where they will build a 50-ton ice-making plant, with provision for enlargement. Power will be obtained from the city hydro-electric plant, and city water will be used for the freezing cans.

London, Ont.—The Dominion Abattoir have just completed the installation of a 30-ton refrigerating plant, consisting of a 10x20 inch electrically driven "Safety" compressor belted to a 50 H.P. electric motor. The plant consists of the complete high pressure side, and over 3,000 lineal feet of 2-inch d.e. piping distributed in hog cooler, beef chill room, beef cooler, bacon cooler, etc. The entire installation was furnished and erected by The Huetteman & Cramer Co., Detroit, Mich.

Calgary, Alta.—The Arctic Ice Co., Winnipeg, Man., has recently built additional ice houses there and are also erecting a large house at Calgary, Alta. Near the latter place they own a shallow artificial pond, easily flooded from the Bow river. The pond is filled and allowed to freeze about 22 to 24 inches, when the water is drained off and the ice lifted out, being conveyed over the C.P.R. to Winnipeg or Calgary.

Montreal, Que.—The Ice Mfg. Co., Ltd., of which W. T. Rodden is president, F. W. Molson, vice-president, and C. G. McCarthy, secretary, has completed its 80-ton ice factory at Frontenac and Mt. Royal avenue and will soon start building a second plant at St. Catherine and Berthiaume streets, to supply ice for the west end.

Trade Gossip

The Montreal office of the International Engineering Works, Ltd., builders of Robb engines, boilers, etc., has been changed to No. 1001 Transportation Building, Montreal.

The S. Morgan Smith Co., have secured a contract to supply the Ottawa Electric Co., with a pair of 48 in. "Smith" cylinder gate turbines of 1700 h.p. capacity, mounted on cast iron draft chest.

Norman G. Neil, Industrial Commissioner for Port Arthur, has accepted a position in North Battleford, Sask. Mr. H. S. H. Goodier, secretary of the Board of Trade, has applied for his position.

The Dominion Coal Co. are to install at their new coal docks at St. John, N.B., four vertical submerged tubular boilers, built for 150 lbs. working pressure by the International Engineering Works, Ltd.

Refrigerating and Engineering, Ltd., Somerset Block, Winnipeg, Man., have been appointed agents for the Terry Steam Turbine Co., Hartford, Conn., for the territory represented by Manitoba, Alberta, and Saskatchewan. The Terry Company already have agents at Toronto and Montreal, Canada.

Mr. F. S. O'Reilly, cashier of Mussens, Ltd., has resigned from the latter position to become accountant for the Canadian branch of Fraser & Chalmers, Limited, the well known manufacturers of mining and power machinery, of London and Erith, whose Canadian offices are at No. 4 Phillips Place, Montreal.

Westerners Visit Eastern Plants.—The Western managers of the Canadian Fairbanks-Morse Co., Ltd., recently paid visits to the company's plants at Toronto, New York, and Montreal. The party included:—C. J. Brittain, Winnipeg, H. Crane, Saskatoon, and F. G. Robinson, Calgary.

Escher, Wyss & Co., Montreal, have received the contract for a pump from the city of Regina for its waterworks system. The pump will have a capacity of 6,250,000 gallons per day and will be driven by a 200 horse-power Belliss and Morcom engine. The contract price for the entire equipment is $16,000.

F. L. Reed, manager of the Schacht Motor Co., Hamilton, will be retained as general manager for the Monarch Motor Co., who have secured the right to manufacture the Schacht cars in Canada. Each shareholder in the Schacht company will receive an equal number of shares in the new company.

The Bowden Machine and Tool Co., of Toronto, are moving their plant from Orillia Street to Sterling Road, where they have erected a larger building. At present work is being carried on in both places. All the necessary new equipment has been purchased. In addition to its present product, the firm will manufacture pumps.

Bettington Boilers.—The Waterford Lake power house of the Dominion Coal Co., Ltd., the equipment for which was supplied by the Canadian branch of Fraser and Chalmers, Ltd., of London, Eng., is now in continuous operation. This central station supplies power for all the mines in the Lingan district, and is equipped with Bettington boilers.

The Siemens Company of Canada, Ltd., recently obtained the order for two 1,900 H.P. peak load electric hoisting engines from the Dominion Coal Co., Nova Scotia. They had previously supplied the Coal Company with other large electric hoisting engines, all of which have given good satisfaction. In addition a total of 10,000 H.P. of electrical machinery has been furnished.

The Siemens Company of Canada, Ltd., have obtained the order for a 400 K.V.A. 200 r.p.m. 3-phase, 60 cycle, 2200 volt generator, with direct coupled exciter for the Corporation of Yorkton, Sask. As in the case of the previous generator supplied by them, the 400 K.V.A. machine just mentioned above will also be direct coupled to a Diesel engine manufactured by Mirrilees, Bickerton & Day of England, who are represented in the Dominion by the Canadian Boving Co., of Toronto.

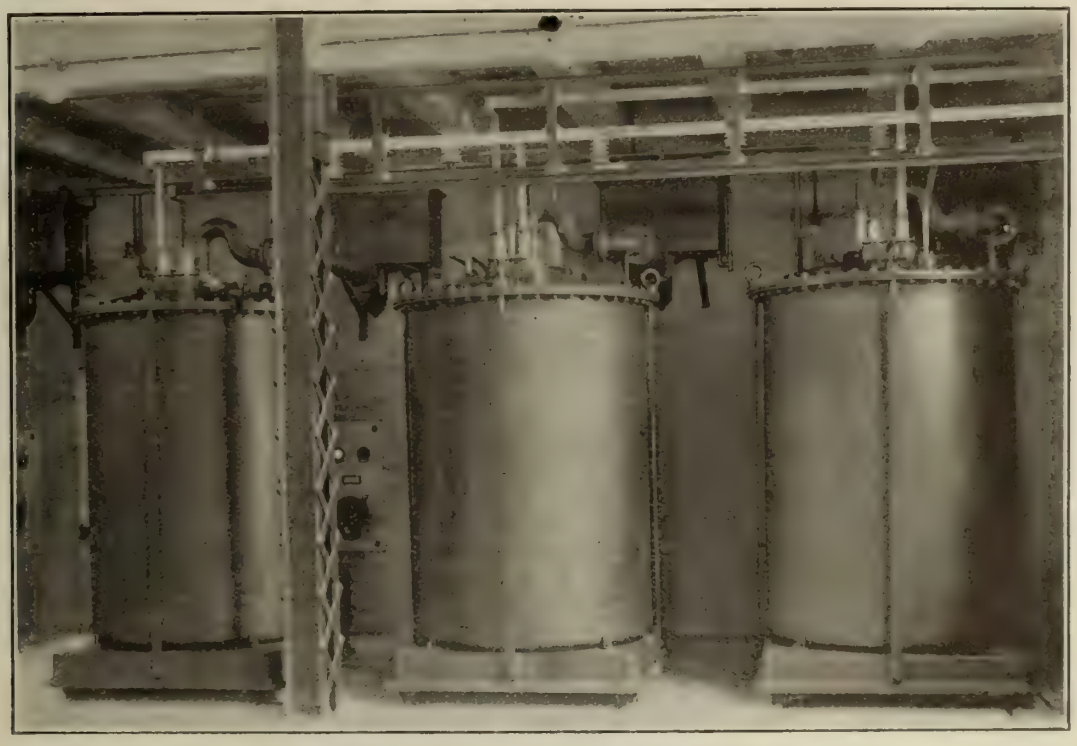
Taylor & Young, Ltd., mechanical engineers, Vancouver, B.C., are furnishing for the Nanaimo Electric Light Co., Nanaimo, B.C., a 450 b.h.p. compound high speed engine, manufactured by James Howden & Co., Glasgow, Scotland, which is direct connected to a 300 k.w., 2,200 volt alternator with direct connected exciter, manufactured by Bruce Peebles & Co., Edinburgh, Scotland. This order is of interest because of the fact that it marks the first installation of this make of engine in British Columbia.

SIEMENS BROS. DYNAMO WORKS | SIEMENS BROS. & CO.

SIEMENS

SIEMENS - SCHUCKERTWERKE | SIEMENS & HALSKE

SIEMENS



THREE OF SEVEN 750 K.V.A. 22,000 VOLT, SINGLE PHASE, OIL INSULATED WATER COOLED TRANSFORMERS, SUPPLIED AND INSTALLED FOR THE CITY OF PORT ARTHUR.

Four of the above were a repeat order after the first bank had been in successful operation for eighteen months.

We also supplied the whole of the switching apparatus, lightning arresters and two 750 h.p. motor generator sets.

Attention is especially drawn to the expansion vessels connected by a pipe to the top of the transformer case. Our transformers are completely filled with oil including this connecting pipe, and part of the expansion vessel, expansion and contraction of the oil taking place in the latter.

By means of the peculiar shape of the connecting pipe the hot oil by the time it rises to the expansion vessel is sufficiently cool so that **no hot oil comes in contact with the air, and no moisture can enter the transformer itself.** This arrangement also keeps the oil in perfect condition and prolongs the life of the transformer.

Siemens Company of Canada, Limited

HEAD OFFICE:

Transportation Building - MONTREAL

BRANCH OFFICES:

STANDARD BANK BUILDING
TORONTO

McARTHUR BUILDING
WINNIPEG

Fraser and Chalmers, Ltd., Montreal, report that they have just closed a contract with the city of Medicine Hat, Alta., for all the steam, exhaust, water and gas piping in connection with the new municipal power plant. This is in addition to the contract which this company had already secured for the main power equipment. The latter consists of two 675 K.W. steam turbine driven alternators and two high lift turbine pumps of 3,000,000 gallons capacity each, together with condensers, exciters, switchboard, etc. Fraser and Chalmers are now shipping a Bettington boiler installation to the Dominion Department of Railways and Canals, for the Moncton shops of the Intercolonial Railway.

The John McDougall Caledonian Iron Works Co., Ltd., of Montreal, have been awarded the contract for two 12 million Imperial gallon pumping units, at a price of $50,046. The units consist of two 20-inch, three-stage Worthington turbine pumps, direct connected to 750 brake horse power Browett-Lindley high speed engines, running at 350 r.p.m. and operating against a water pressure of 92 pounds. The three-stage pump of the John McDougall Co. was selected as a type that already had given the city very satisfactory service for a number of years, operating 24 hours per day. This makes the thirteenth pumping unit furnished to the City of Montreal by the John McDougall Co. and Henry R. Worthington, aggregating a total pumping capacity of over 100 million Imperial gallons.

The Hare Engineering Co., Ltd., 14 King St. East, Toronto, report the following orders recently received:—For Algoma Steel Corporation, Ltd., Sault Ste. Marie, Ont., a 575 H.P. condensing Terry steam turbine, direct connected to a single stage, 20in., Epping-Carpenter double suction volute pump having a capacity of 15,000,000 Imperial gallons per 24 hours. The turbine is direct connected to the pump, and will run at 1,200 r.p.m. A 225 H.P. Terry steam turbine for the O'Keefe Brewing Co., Toronto, to be operated on exhaust steam at 3 lbs. per gauge to 27in. vacuum. The turbine will run at 2,000 r.p.m. and be direct connected to a 150 K.W., D.C., Crocker-Wheeler generator. The vacuum is secured by a 1,000 ft. Wheeler condenser with Wheeler-Edwards vertical air pump, and 25 H.P. Terry steam turbine, direct connected to a centrifugal circulating pump. The cooling tower will be placed on the roof of the building, 80 feet above the condenser. A large stoker fired forge furnace for the Nova Scotia Steel & Coal Co., of New Glasgow, N.S. This furnace is practically a duplicate of the one recently installed by The Canada Forge Co., Welland. The application of stokers to properly designed furnaces resulted in a saving of over 38 per cent. in fuel costs. An order for two No. 7,208 180 H.P. Fulton water-cooled mechanical stokers for the new plant of Rolph & Clark, Ltd., Toronto. These have now been in use 3 months and are understood to be giving excellent satisfaction. The coal consumption per k.w. hour is remarkably low, although the lowest grades of slack and colliery refuse are being burned.

Tenders

Drummondville, Que.—The Council will receive until April tenders for: (1) The construction of a reservoir (stand pipe) at Drummondville, capacity 200,000 gallons; (2) tenders for another of 300,000 gallons. W. A. Moisan, secretary and treasurer.

Hamilton, Ont.—Some of the contracts for the year's supplies are as follows: Small extension boxes, 2,500, $1.38 each, Forwell Foundry Co.; large extension boxes, 500, $1.48 each, Forwell Foundry Co.; brass supplies, valves, couplings, etc., Tallman Brass and Metal Co., $8,123.05; 100 tons pig lead, $4.24 per 100 pounds, Tallman Brass and Metal Company; 125 tons lead pipe, $4.80 per 100 pounds, delivered at city yard. Canada Metal Co.; valve gates, $1,555.02; gate valves, Darling Pump Manufacturing Co., $1,345.80; cast-iron pipe, $34.50 per ton, Gartshore Thomson Co.

Ottawa Ont.—Tenders for accessories to be used this year by the civic waterworks department were opened on Wednesday, Feb. 26, by the waterworks committee, when the following awards were recommended: Brass goods, the Robert Mitchell Co., Montreal, $2,456.30; cast iron pipe, Canada Iron Corporation, Montreal, $16,655.43; hydrants, Thomas Lawson & Sons, Ltd., Ottawa, $49.75 each; lead pipe and pig lead, Capital Hardware Co., Ottawa, $2,353.10; oils and grease Capital Warehousing Co., Ottawa, $407.50; special pipe castings, Thomas Lawson & Sons, Ltd., Ottawa, $3.50. In every case the lowest tender was accepted.

Personal

South Saanich, B.C., is in need of a permanent engineer.

J. H. Bottomley, secretary of the Welland electric light plant, has resigned.

M. H. Baker, city engineer at St. Thomas, Ont., was appointed city engineer of Prince Albert, Sask., on Monday night, March 3, at an initial salary of $2,500.

W. A. Ostom, chief electrician in the Saskatoon power house, has resigned to re-enter the employ of the Canadian General Electric Co., as superintendent of construction in the west.

Mr. Allan A. McQueen, B.A.Sc., an honor graduate of the School of Practical Science, Toronto University, 1912, has just received the appointment of assistant power engineer of the city light and power system of Winnipeg. Mr. McQueen was at one time connected with the Toronto Hydro-Electric system.

A. W. Roger Wilky, C.E., for the past eight years on the engineering staff of the Island branch of the Canadian Pacific Railway, has been appointed engineer-in-charge of all construction work of the Department of Marine and Fisheries for the province of British Columbia.

Thomas Coltrin Keefer, C.M.G., LL.D., of Ottawa, past president of the Canadian Society of Civil Engineers, has and past president of the American Society of Civil Engineers, has been elected as honorary member of the Institute of Civil Engineers. Mr. Keefer is one of the most eminent members of the profession in Canada, and since his entry in 1838 he has rendered civil engineering inestimable service.

New Incorporations

The Hygeia Ice Co., Ltd., incorporated at Ottawa with $1,500,000 capital, to manufacture ice at Montreal; incorporators, Wilfred Bovey, Robertson Fleet, Joseph A. L'Heureux, Lillian M. Gamble, Edith H. Delight, of Montreal.

Canadian De La Vergne Co., Ltd.—Incorporated at Ottawa, to manufacture refrigerating machinery at Montreal. Capital, $50,000; incorporators, Francis G. Bush, George R. Drennan, Michael J. O'Brien, Herbert W. Jackson, Gordon F. Macnaughton, all of Montreal.

Wayne Oil Tank & Pump Co., Ltd., incorporated at Ottawa, with $50,000 capital to take over the Wayne Oil Tank & Pump Co., Toronto; incorporators, Clifton M. Johnston, George R. Kappele, William H. McGuire, George F. Rooney, Lowell W. Wood, all of the City of Toronto.

Ottawa, Ont.—Official notice is given of the Federal incorporation of a new twnty-million-dollar company under the name of the International Light & Power Company, Limited, with headquarters in Toronto. The provisional directors are given as clerks in a legal office usually associated with Mackenzie & Mann enterprises. The company is empowered to carry on all kinds of hydro-electric power enterprises through-

LIBERTY BOILER TUBE CLEANERS

ARE THE

BEST POSSIBLE INSURANCE

AGAINST BOILER ROOM ACCIDENTS. Even a light coating of scale on the tube prevents the water from coming in contact with the metal, and the intense heat to which boiler tubes are subjected burns out the metal and an explosion is liable to happen, which frequently results in the loss of life.

LIBERTY CLEANERS are not only a safeguard against accidents of this nature, but are a **remunerative investment**. They will save in fuel their purchase price every month.

If you have been experimenting with other types of cleaners which have failed to make good, do not put the **Liberty** in the same class, but let us send you one on trial, to prove their superiority and show you what a **real Cleaner** can do.

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Liberty Manufacturing Company

6904 Susquehanna Street **PITTSBURGH, PA.**

Canadian Representatives:
Williams & Wilson, Ltd., Montreal. A. R. Williams Machinery Co., Toronto and Winnipeg.

T is
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N eeded

to protect every plant that draws its water supply from lakes, ponds or rivers.

A six-hour catch of fish, leaves, etc., made by one basket of a Twin Strainer.

Such
Troublesome
Rubbish
Abounds
In
Nearly
Every
River or
Stream

and the only convenient and efficient way to remove it from your water supply is with a Twin Strainer.

The TWIN STRAINER has two straining baskets and is made so that either one of the baskets may be cut out of the line at any time for cleaning, by simply shifting two valves.

If you are not acquainted with the Twin Strainer write for our catalog. It's ready for you.

ELLIOTT COMPANY

6902 Susquehanna Street, **PITTSBURGH, PA.**

CANADIAN REPRESENTATIVES;
Williams & Wilson, Ltd., Montreal. A. R. Williams Machinery Co., Ltd., Toronto and Winnipeg.

The advertiser would like to know where you saw his advertisement—tell him.

out the Dominion of Canada or elsewhere.

Catalogues

The Goetze Gasket and Packing Co., packing specialists, of New Brunswick, N.J., are sending out a hanger containing handy tables of gasket sizes for various pipes, and their prices.

The Hoppes Mfg. Co., Springfield, Ohio, make steam specialties. These are described succinctly in a booklet just out, which the firm will, no doubt, send to anyone interested in feed water heaters, oil extractors, steam separators, exhaust heads, and the like. Their heaters are made to suit the requirements of any kind of water.

The Powers Regulator Co., 111 Fifth Avenue, New York, forward a copy of their bulletin dealing with the Powers system of automatic temperature control in connection with the heating of buildings. This system is too well-known to need more than mention, yet even those who are thoroughly familiar with it will doubtless value this catalogue, which is very clearly written and of most artistic appearance.

Bulletin 62, entitled "**The Electron Theory of Magnetism,**" by E. H. Williams has just been issued by the Engineering Experiment Station of the University of Illinois. This is a mathematical discussion of the new theory of magnetism. The bulletin traces the experimental evidence leading to the development of this theory, defines its present status, and points out certain phenomena which the theory in its present form fails satisfactorily to explain.

Can. Westinghouse Co.—It is a pleasure to take up one of the neat bulletins issued by the Canadian Westinghouse Company, Ltd., Hamilton, Ont., dealing with any of their products. The covers are inviting, the paper is of first class quality, and the reading matter and illustrations always clear and interesting. This one, dealing with the serviceability of their motors, appeals to the farmer, the woodworker, the machinist, and the printer, giving examples of the use of the electric motor in their trades. Another bulletin on "**How Westinghouse Small Motors Can Help You,**" contains suggestions for saving time and labor in homes, hotels, restaurants, offices, stores, shops, and on the farm. The same concern have sent us a work by way Operation. Among the subjects treated are:—1. The discussion of field control for speed regulation, and 2. the matter treating of the correct application of motor equipment for a specific purpose. It is a reprint of paper read by Mr. Wynne before the Baltimore section of the American Institute of Electrical Engineers.

The Hawley Down Draft Furnace Co., Easton, Penn., are issuing a well printed catalogue, which clearly describes the various interesting features of the Hawley (Schwartz) metal melting furnaces. This catalogue is more especially devoted to the presentation of the advantages that the Schwartz furnace offers in the melting of small heats of iron and steel. It is in the melting of these small heats, for which the Bessemer and open-hearth furnaces are unsuitable, that the particular field of usefulness claimed for Hawley (Schwartz) furnace lies. This furnace is somewhat similar in outside appearance to a small Bessemer converter, the metal being first melted in a cupola, as in the Bessemer process. The subsequent conversion of the charge into steel, however, is carried out, as in the open hearth process, by the heat of a gas or oil flame playing over the surface of the bath of metal. Pouring is done either into ladles or directly into moulds. In cases where it is easier to move the furnace to the flasks than to bring the flasks to the furnace or to resort to ladles the company make a special type of furnace that can be readily disconnected and lifted off its housings by a crane and carried up and down the aisles of the pouring floor.

"**Superheating**" is the title of a 16-page pamphlet published by the Heine Safety Boiler Co., St. Louis, Mo. The first part of the pamphlet is a reprint of a paper from the Journal of the Engineers' Society of Pa., discussing the steam and fuel economy of superheating, the various designs of superheaters, the methods used for obtaining control of the temperature of superheat, and a brief description of the design and operation of the Heine superheater. The Heine superheater is installed at the side of the main boiler drum, in a superheater chamber, forming part of the main boiler setting. The superheater chamber connects with the surface by a flue through which a small percentage of the furnace gases flow. A damper at the outlet of the superheater controls the volume of gases, and, therefore, the superheat temperature. A chart is reproduced in the pamphlet which shows the performance of a Heine superheater, and illustrates how the steam temperature is maintained within about 5 deg. of the mean. The last part of the pamphlet is devoted to abstracts from the Transactions of the American Society of Mechanical Engineers on the effect of superheated steam on cast iron. These notes give examples of the serious effects of fluctuating and excessive temperatures. Copies of this pamphlet will be sent to engineers on request to the Heine Safety Boiler Co., St. Louis, Mo.

$20,000,000 LIGHT AND POWER CO.

OFFICIAL notice is given of the Federal incorporation of a new twenty-million-dollar company under the name of the International Light and Power Co., Ltd., with headquarters in Toronto. The provisional directors are given as clerks in a legal office usually associated with Mackenzie & Mann interests. The company is empowered to carry on all kinds of hydro-electric power enterprises throughout the Dominion of Canada or elsewhere.

Port Arthur, Ont.—The Canadian Development and Resources Co., Ltd., will build an elevator and a cement manufacturing plant at once.

FOR SALE

By the Town of Whitby, at very low prices,

1 Bullock Generator, 2 phase, 2,200 volts, 60 cycle, 100 k.v.a.
1 Inglis Corliss Engine, 150 h.p.
1 Boiler, 75 h.p.

Also complete switch-board, shafting, hangers, belting, clutch couplings, in fact a complete electric plant in first-class running condition. Apply,

W. J. LUKE,
Sec. Light Com.

O t.f.

CITY OF SASKATOON

Machinery For Sale

One "Robb Armstrong" Horizontal Engine.

One "Canadian Westinghouse" Alternating Current Generator, 2 phase, 60 cycle, 125 k.w., 2,200 volts.

One Jet Condenser Air Pump.

Two "Canadian Foundry Company" Horizontal Tubular Boilers, each 250 h.p. capacity.

One "Robb Armstrong" Horizontal Engine, arranged for direct connection to a 225 k.w. generator on a 13 inch shaft.

One "Allis-Chalmers-Bullock" Generator—Rating 225 k.w., 2,200 volts, 2 phase, 60 cycle, 150 r.p.m.

Exciter, Allis-Chalmers-Bullock. Rating 104 Apms., 120 volts, 1,000 r.p.m.

Full particulars may be obtained on application to E. Hanson, City Electrical Engineer, Saskatoon.

Offers, endorsed on outside of envelope "Offer for Engines, Generators and Boilers," should be addressed to The City Commissioners, Saskatoon.

F. E. HARRISON, Mayor,
Chairman of Commissioners.

Saskatoon, March 5th, 1913.

CLASSIFIED ADVERTISING

FOR SALE

GAS ENGINES FOR SALE — 66 B.H.P. Hornsby-Stockport gas engine and plant, also 80 B.H.P. natural gas engine for immediate delivery. Particulars, Richard Hornsby & Sons, Limited, 212 McGill St., Montreal. (4)

COMPOUND ENGINE, 1—12 inch x 23 inches x 30 inches Right-Hand Tandem Compound. Wheelock Engine in excellent condition can be bought at a bargain. Thos. Hobbs, Mail Bldg., Toronto. (3)

ONE KEIGHLEY GAS ENGINE, 45 H.P. IN first-class shape. Reason for selling: Equipping new plant with Electric Power. This engine can be seen running at any time at present works. The Thomson Monument Co., 1194 Yonge St., Toronto.

ENGINE AND GENERATOR, 1—21" x 36" x 24" Vertical Cross Compound Corliss Engine, direct-connected to 400 k.w. 250 volt. Can. Gen. Elec. Generator in excellent condition only used short while can be bought for one-fifth of original cost, or can dicard generator and make good mill outfit. Thos Hobbs, Mail Bldg., Toronto. (3)

BELTING FOR SALE—800,000 FEET OF best quality leather, rubber, hair and canvas belting, bought from bankrupt manufacturers at 25% to 75% less than the regular value. Also a large quantity of slightly used belting, piping, chains, rails, pulleys, hangers, cotton waste, etc., at very low prices. Send for catalogue. Imperial Belting and Supply Co., 5 Queen Street, Montreal.

WANTED

WANTED—CANADIAN REPRESENTATIVE to distribute ice making and refrigerating machinery, internal combustion engines of all kinds, and special machinery of any kind built to order. Cleveland Ice Machine & Mfg. Co., Lorain, Ohio, U.S.A.

SITUATION WANTED

WHO WANTS ME — ENGINEER WISHES position in steam power plant, 9 years' experience at sea. First-class Engineers' certificate, excellent references. Stationary engineers' certificate, experienced Corliss, Wheelock or slide valve engine, water tube or fire tube boilers, oil fuel or coal, economizers, superheaters, air compressors, hydraulics, all kinds pumps, generators, motors, wiring steamfitter, hard worker, sober, good education, 34, single. Engineer, 82 Kinrade Ave, Hamilton, Ont. (3)

MISCELLANEOUS

BECAUSE THE REMINGTON TYPEWRITER Company's Employment Department has earned the reputation among stenographers of filling the most desirable office positions, the result is that we place the most desirable class of office help. May we fill your stenographic vacancy? No fees. 144 Bay St., Toronto.

SALESMEN WANTED

LAKE ERIE BOILER COMPOUND CO. REquire a few first-class representatives to sell their well-known compound. Liberal commission paid to live men, and exclusive territory. Write at once, giving references, 11 Colborne St., Toronto. (tf)

WANTED — EVERY POWER HOUSE IN Canada to remember that C. E. Shedrick, Craig Street West, Montreal, is still repairing measuring instruments, both switchboard and portable. Twenty-five years' experience in repairing all kinds and makes on the market. Integrating meters repaired, tested and sealed, and returned on quick time.

QUIT
TAKING CHANCES
ON YOUR
ELECTRICAL REPAIRS

Look over your shop and send us that old MOTOR or DYNAMO that needs winding or repairing.

Tell us your electrical troubles. We fix anything — anywhere.

We do work from Rimouski to Winnipeg.

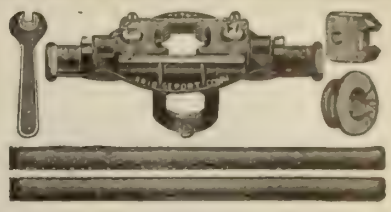
To-day is the day to write. Promptness our motto.

Absolute guarantee of satisfaction or money back.

What more do you want?

MEAD ELECTRIC CO., LIMITED
23 St. George St. Montreal, Que.

U.S. AND BARKEEPERS FRIEND
METAL POLISH
USED AND ENDORSED BY THE LEADING DEALERS
SOLD ALL OVER THE WORLD



GENUINE
ARMSTRONG STOCKS
AND DIES
FOR CUTTING PIPE & BOLTS
ARE THE BEST.

PIPE MACHINES
PIPE CUTTERS
HINGED PIPE VISES
RATCHET ATTACHMENTS

Manufactured by
THE ARMSTRONG MFG. CO.
298 Knowlton St.
BRIDGEPORT, CONN.
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DIXON'S
GRAPHITE
LUBRICANTS

Dixon's Flake Granphite No. 1
This is the standard size of Dixon's Ticonderoga Flake Graphite, and is recommended for general lubricating requirements.

Dixon's Flake Granphite No. 2
A more finely ground graphite than No. 1, though of the same stock. This is adapted to close-fitting bearings and delicate mechanism.

Dixon's Special Granphite No. 635
This is a selected grade of Dixon's Ticonderoga Flake Graphite ground even finer than the No. 2 Flake. It is widely used in stationary gas engines. This grade of graphite is also used on type-setting machinery.

Dixon's Waterproof Graphite Grease
A strongly adhesive grease of heavy body; cannot be washed off by fresh, salt, alkaline, or acid water. Especially adapted for wire rope, gears, slides, chains, elevatorways, mining and quarrying machinery, and generally on machinery exposed to water or the weather.

"Graphite As a Lubricant," and Sample 222C free.

JOSEPH DIXON CRUCIBLE CO.
Jersey CitS, N.J.

HAVE YOU TRIED
MONCRIEFF'S "UNIFIC" WATER GAUGE GLASSES?
They never corrode. They last longer. They defy competition.
For full information apply to our Canadian Representative,
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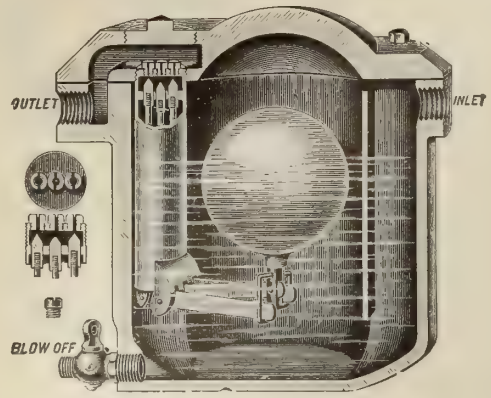
BEATH
CRANES
CHAIN BLOCKS
TROLLEYS
OVERHEAD RUNWAYS

Solve Coal, Machinery and Merchandise Handling Problems.
Hand, Pneumatic and Electrically Operated.
Tell us what you wish to do, and we'll suggest the proper equipment for you.
W. D. BEATH & SON, Limited
Engineers and Manufacturers
20-30 Cooper Ave. TORONTO



Wright
"Emergency" High Pressure Continual Flow Steam Trap

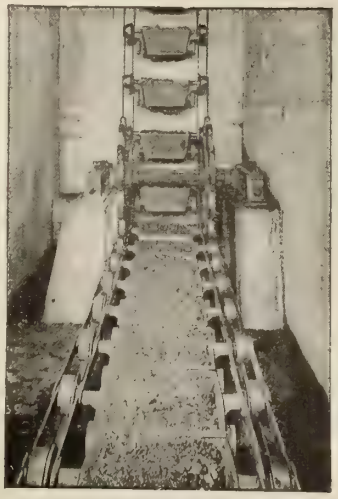
THREE VALVES

GREAT CAPACITY

Keeps the steam line automatically and continually drained of accumulating condensation.
Shipped subject to trial and return if results are not satisfactory.
Send for Catalog.

DARLING BROS., Limited
15 Ottawa Street, MONTREAL
TORONTO WINNIPEG ST. JOHN, N.B.

Economy is the Keynote of Construction
IN BUILDING A
Jeffrey Coal and Ashes Handling System



The same conveyer handles both coal and ashes — the conveyer itself occupies minimum space — not an ounce of energy is wasted — a uniform loading of buckets insures no spillage.

Catalogue 32-A shows how over fifty Power Plants have solved the economy problem in Handling their Coal and Ashes. Write for free copy.

JEFFREY MANUFACTURING CO.
Canadian Works and Main Office, MONTREAL
Winnipeg Representatives, N. J. DINNEN & CO.

Machine Banded Wood Stave
WATERPIPES and TANKS

For city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited
P.O. Box 563 Vancouver, B.C
WRITE FOR CATALOGUE
Full Particulars and Estimates Furnished

The advertiser would like to know where you saw his advertisement—tell him.

Canadian Association

OF

Stationary Engineers

To all whom it may concern:

All those operating steam or electrical plants know that to advance in their special profession something new must be added constantly to keep up with the rapid developments in all the branches of the engineering profession. To you I offer the undisputed facilities and benefits to be derived by being a member of the C.A.S.E. This year has seen greater developments in our executive, owing to the aforesaid profession advancing so rapidly.

It is the wish of the present membership that all operating engineers should become members, so that we may hold our profession in the front ranks of scientific industry.

You will readily see the great advantages that would accrue from such a source.

If not a member
Why not a member?

Act at once and write for further information concerning membership to

A. KASTELLA,
Executive Secretary,
Stratford, Ont.

"So Pleased with Results from Cling-Surface we have forgotten the price."

When Mr. J. H. Wilcox, Wilcox Fertilizer Co., Mystic, Conn., said this, he voiced a sentiment common among Cling-Surface users.

Cling-Surface to a belt, like food to a human being, is essential to life and vigor. It is a good, wholesome, inexpensive food applied to belts, primarily to preserve their original strength, pliability, gripping power and efficiency and to prolong their life.

Besides accomplishing these important objects, Cling-Surface permits further savings outside the belt that are even greater. As a Cling-Surface-treated belt may be run with maximum slack, the power ordinarily lost in unnecessary friction as where the belt is run tight, is saved. The constantly reduced belt tension possible only with Cling-Surface treatment makes babbitted bearings last longer, materially cuts down lubrication and as the belt is not strained by useless overload, the expense of belt repairs and renewals is greatly lessened. The amount of these savings in belt driven shops and power stations is often almost unbelievable.

A Simple Test that Demonstrates the Action of Cling-Surface.

Make pulley fast, and grip an untreated belt.

Then grip bare pulley.

Then try with a Cling - Surface-treated belt.. You can easily feel the decided difference in resistance to slip.

Summarizing, Cling-Surface stops power waste, checks undue depreciation, and reduces costs throughout the whole transmission system.

Cling-Surface does not stop at the belt surface, but penetrates, surrounds and lubricates every fibre, thus making the belt pliable throughout—capable of intimate pulley contact and of pulling without slip.

Try Cling-Surface at our risk, or at least ask your engineering acquaintances about it; and then send for our literature.

We carry stock in Toronto and can quote you f.o.b. that point, duty paid. Please address us, however, to address below.

Cling-Surface Co

1057 Niagara Street Buffalo N Y

52

HINTS TO BUYERS

ALLIGATOR BELT LACING

FLEXIBLE STEEL

Makes Joints Quickly.

Only a Hammer Required.

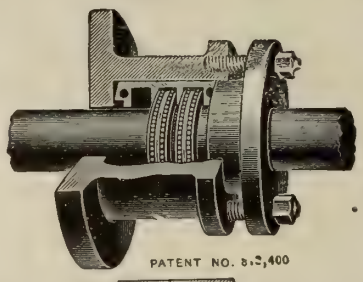
No Holes to Punch.

Forms the Strongest Part of The BELT.

Let Us Send One On Trial.

The Crescent Oil Company, Hamilton and Toronto, Ont

Stocks carried by—Sadler & Haworth, Montreal; Austen Bros., Halifax; P. A. Gouin, Three Rivers, P.Q.; J. S. Mitchell & Co., Sherbrooke, P.Q.; Great West Engine Packing Co., Winnipeg; F. H. Andrews & Son, Quebec, P.Q.; E. N. Jones, St. John, N.B.



PATENT NO. 8[illegible]2,400

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Why not Buy the Best, when in market for Packing?

HOLMES'

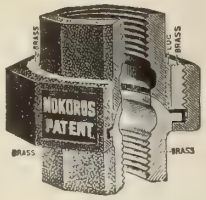
Metallic Packing

is Guaranteed 3 years

Lasts many times longer. 30 days trial. Less oil. No cutting. Easily applied to any Steam Engine, Air Compressor or Gas Engine. Satisfaction or no pay. Write us.

Holmes Metallic Packing Co., Wilkes-Barre, Pa.

The Nokoros Patent Union



The only union made absolutely Non-Corrosive. Brass to iron in all contact points. Ball joint; Octagon ends, any wrench can be used. Adapted for heavy service. Every union air tested at factory. Send for circular B, describing the above and other fittings made by

Tested & Guaranteed

OTTERVILLE MFG. CO., LIMITED

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SCANDINAVIA BELTING — FEDERAL ENGINEERING & SUPPLIES LIMITED — TORONTO

SPECIAL HIGH SPEED LEATHER BELTING.

TRADE MARK — LANCO BALATA — BELTING

FEDERAL ENGINEERING CO.

LIMITED

90 Sherbourne St. TORONTO

Unity Building MONTREAL

Mueller Pressure Reducing and Regulating Valves

Give accurate and absolute control of pressures of water, steam, air, gas, oil, carbonic and acetylene gases—in fact, all kinds of pressures. Their efficiency is firmly established. Manufactured under Canadian patent No. 127,566. Address:

DOHERTY MFG. CO., Limited

Sarnia - Ontario

Manufacturer for The H. MUELLER MFG. CO., Decatur, Ill., and New York City.

Notice to Stationary Engineers

Everyone operating a Stationary Steam Plant of 50 h.p. or over, in the Province of Ontario, must hold a Certificate from this Board. Anyone operating such a plant without a Certificate is liable to the penalties set forth in the Stationary Engineers' Act

HON. J. S. DUFF, Minister of Agriculture.

W. C. McGHIE, Chairman of Board, Parliament Buildings, Toronto

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EVERYTHING FOR

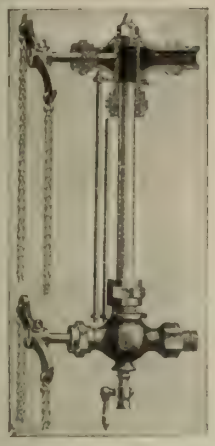
Engineers and Draughtsmen

THE ART METROPOLE
241 YONGE STREET TORONTO
ARTISTS AND DRAUGHTSMENS MATERIALS

Faber's No. 368, Slide Rule, specially graduated for Electrical Computations.

WRITE FOR CATALOGUE.

THE ART METROPOLE
241 YONGE STREET, TORONTO



—OHIO—
Water Gauge

Comes to you fitted with high grade steam packing—ready to use.

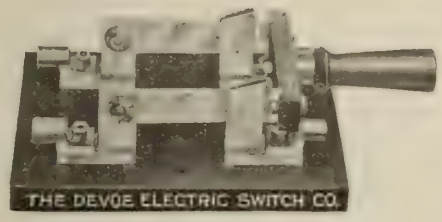
Chain operation protects user.

Ohio Water Gauges, Gauge Cocks and Regulating Valves can be obtained promptly from your dealer.

Write for Catalogue K-C.

The Ohio Brass Co., Mansfield, O.

SWITCHES

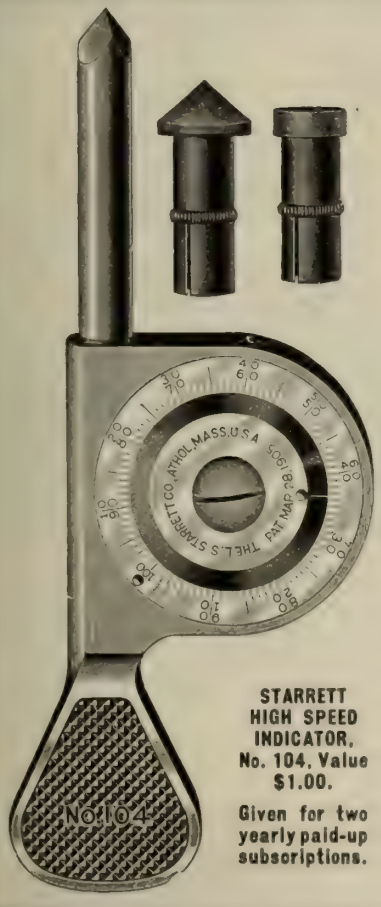


SWITCHBOARDS, PANEL BOARDS, STEEL BOXES and CABINETS for every purpose. : : : :

Send us your specifications.

Write for Switch Catalogue : : No. 6. : :

THE DEVOE ELECTRIC SWITCH COMPANY
157 Craig Street West MONTREAL



STARRETT HIGH SPEED INDICATOR, No. 104, Value $1.00.
Given for two yearly paid-up subscriptions.

You May Have This Speed Indicator without Spending a Cent

if you are a subscriber to "THE POWER HOUSE." If you are not a subscriber, send in your own subscription together with two others, and the indicator you are entitled to will be mailed to you immediately.

To subscribers who send us two NEW yearly paid-up subscriptions we will send this $1.00 Indicator.

"THE POWER HOUSE' is designed to give Canadian Engineers, Superintendents and Power Users all the latest and best information in the engineering field. A little work among your engineer friends and acquaintances wil earn for you this handy indicator without any trouble. Try it and see how easy it will be.

PUBLISHED MONTHLY AT $1.00 PER YEAR
Start in TO-DAY to earn one of these Handy Tools.

THE POWER HOUSE 143 University Ave., Toronto

The advertiser would like to know where you saw his advertisement—tell him.

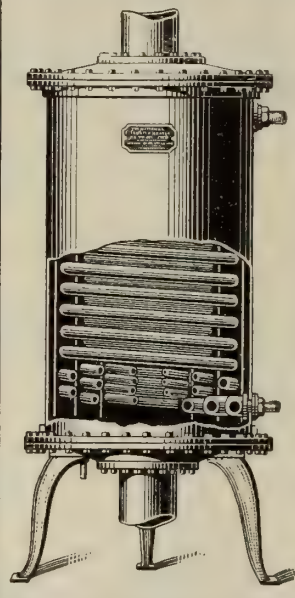
IN counting the revolutions of engines, turbines, motors, line shafting or the revolving parts of any machine, there is nothing equal to the

STARRETT SPEED INDICATOR

Made in Three Styles to suit various needs. No. 104 costs only $1.00. Send for Catalogue 19 CD.

THE L. S. STARRETT COMPANY
ATHOL, MASS.
42-147

Over 3,000,000 H. P. of NATIONAL Feed Water Heaters



Now in Use

You don't have to use so much coal, for part of the heating is done by the exhaust steam.

You don't have to handle so much ash and clinker.

The boiler stays in good condition much longer for there's less wear and tear with hot feed water.

The heater will cause you no trouble for it's free from complications.

Ask for Catalog No. 1

THE NATIONAL PIPE BENDING CO.
91 Lloyd St., New Haven, Conn.
46-20

SAVES FUEL, SAVES LABOR, INCREASES BOILER EFFICIENCY

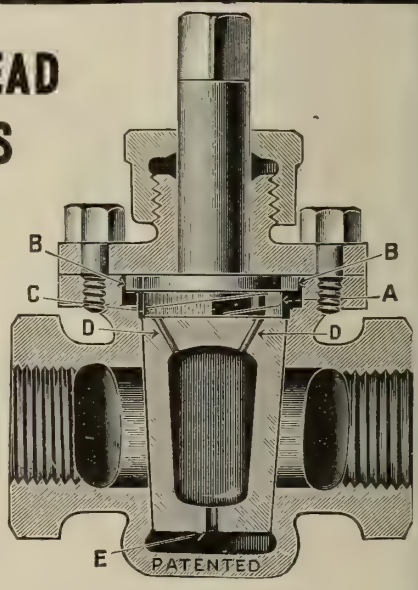
'THE HENRY' STEAM FLUE CLEANER

Cleans Tubes While Boiler Is In Actual Use

THE STEAM APPLIANCE CO.
MILWAUKEE, WISCONSIN.
CANADA SALES CO., Donalda Bldg., Winnipeg

HOMESTEAD VALVES

Have no Equal for Simplicity and Durability



They are unexcelled for any service involving the handling of high pressures in steam, gas, water or hydraulic work. The seats are absolutely protected against wear. The plug is balanced and held in place by pressure when open, and when closed it is locked in the seat by our patent wedging cam. That's what makes Homestead Valves outwear all others.

A quarter turn opens or closes the valve—no waste of time or energy.

A catalogue describing Homestead Valves is yours if you tell us where to send it.

Homestead Valve Mfg. Co.
Works: HOMESTEAD, PA.
P.O. Box 1754, Pittsburg.

The advertiser would like to know where you saw his advertisement—tell him.

THE
CANADIAN CASUALTY
AND
BOILER INSURANCE
COMPANY

ATTENTION:

In what condition have you left your heating boiler? we would like the privilege to inspect it, and report to you what has to be done before the next heating season.

CONTINENTAL LIFE BUILDING
TORONTO

J. O. B. Latour, Chief Engineer.
John J. Durance, Manager.

Phone Main 6941

You Can Remove Scale
And Save Much Money
BY USING
WALKER'S ELECTRIC
BOILER COMPOUND

The cost of using this compound is so little compared with that of other methods of removing scale that you cannot afford not to use it.

Only a very small quantity used regularly will keep your tubes absolutely clean, and prevent pitting, corrosion, foaming, etc.

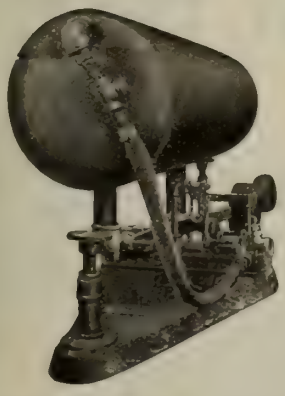
We guarantee it not to injure tubes or fittings.

WRITE TO-DAY.

High Grade Oils

Regal Valve Oil	Vulcan Machine Oil
Red Star Cylinder Oil	Heavy Red Machine Oil
Monarch Cylinder Oil	Brush Dynamo Oil
Superior Engine Oil	Gas Engine Oil and all
Electric Engine Oil	Engine Supplies

The Electric Boiler Compound
COMPANY, LIMITED
Guelph, - - Ontario



The
Morehead
Condenser
Trap
makes its
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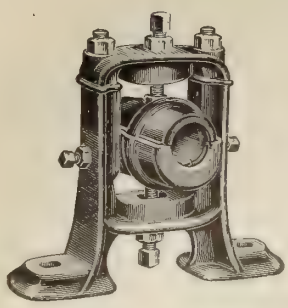

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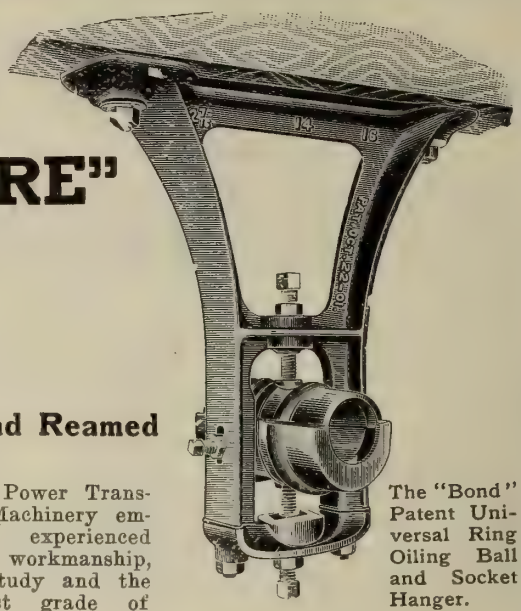

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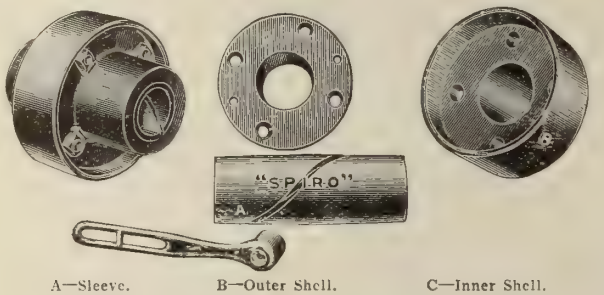

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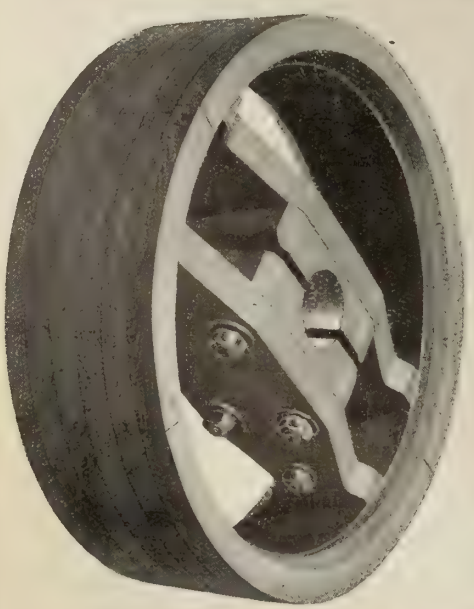

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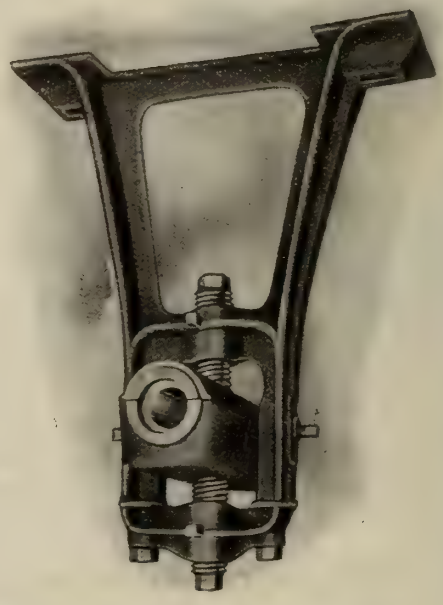

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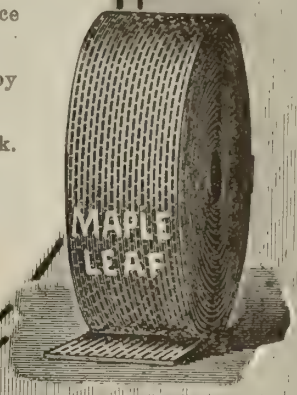

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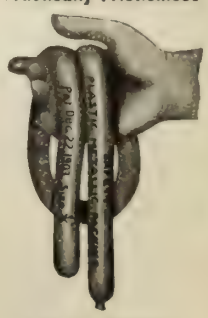

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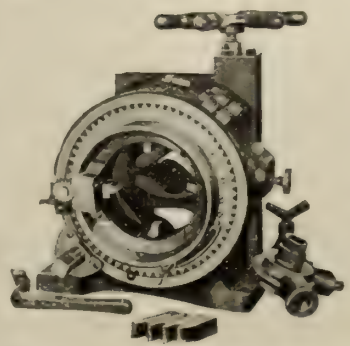

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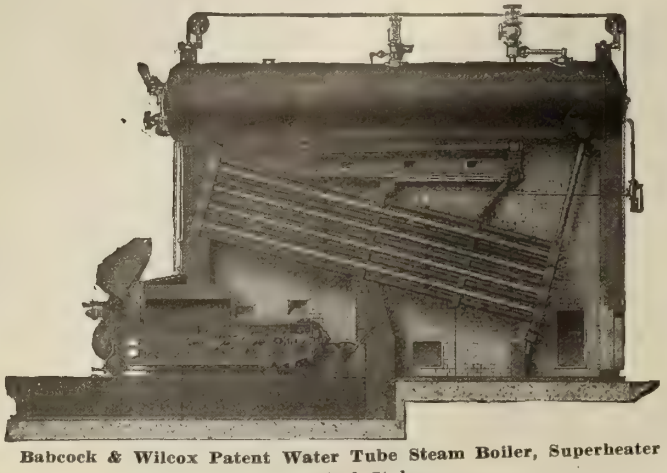

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Steam Appliance Co., Milwaukee, Wis.
Watson & McDaniel Co., Philadelphia

Expansion Joints.
Alberger Condenser Co., New York.
Lunkenheimer Co., Cincinnati, O.

Feed Water Alarms.
H. L. Peiler & Co., Montreal.

Feed Water Analyser.
Dearborn Chemical Co., Chicago.
C. C. Snowdon, Calgary.

Feed Water Heaters.
Alberger Condenser Co., New York.
Babcock & Wilcox, Montreal.
Can. Fairbanks-Morse Co., Montreal.
Canada Foundry Co., Ltd., Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
Elliott Co., Pittsburgh, Pa.
General Supply Co. of Canada, Ottawa
Hare Eng. Co., Toronto.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
National Pipe Bending Co., New Haven, Conn.
H. L. Peiler & Co., Montreal.
Robb Engineering Co., Amherst, N.S.
The Sims Co., Erie, Pa.
Waterous Engine Works Co., Brantford.

Feed Water Regulators.
Canada Foundry Co., Ltd., Toronto.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
H. L. Peiler & Co., Montreal.

Filters.
John McDougall Caledonian Iron Wks, Montreal.

Fire Hose.
Dunlop Tire and Rubber Goods Co., Toronto.
Quaker City Rubber Co., Philadelphia, Pa.

Fire Brick.
Alex. Gibb, Montreal.

Fireproof Cold Store Doors and Windows.
Jones Cold Store Door Co., Hagerstown, Md.

Flanges.
Dart Union Co., Toronto.
General Supply Co. of Canada, Ottawa
Lunkenheimer Co., Cincinnati, O.

Flue Brushes.
General Supply Co. of Canada, Ottawa
Steam Appliance Co., Milwaukee, Wis.

Flumes, Steel.
Canada Foundry Co., Ltd., Toronto.
Canadian Boving Co., Toronto.
E. Leonard & Sons, London, Ont.

Freezer Doors.
Jones Cold Store Door Co., Hagerstown, Md.

Insulators.
Ed. Bennis & Co., Ltd.
Geo. H. Tod, Toronto.

Furnace Linings.
Hare Eng. Co., Toronto.

Fuses.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.
Canadian General Electric Co., Ltd., Toronto.

Gaskets, Rubber, Asbestos and Copper.
Can. Gasket Co., Bridgeburg, Ont.
Goetze-Gasket & Packing Co., New Brunswick.
Canadian H. W. Johns-Manville Co. Ltd., Toronto.
Dunlop Tire and Rubber Goods Co., Toronto.
Garlock Packing Co., Hamilton, Ont.
General Supply Co. of Canada, Ottawa

Gas Exhausters.
Hare Eng. Co., Toronto.

Gas Producer Plants.
Canadian Boving Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Canada Foundry Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Fraser & Chalmers, Ltd., Montreal.
E. Leonard & Sons, London, Ont.

Gasolene & Oil Storage & Distributing Systems.
S. F. Bowser & Co., Inc., Toronto.

Gauge Cocks.
Can. Fairbanks-Morse Co., Montreal.
General Supply Co. of Canada, Ottawa
Hare Eng. Co., Toronto.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
Ohio Brass Co., Mansfield, Ohio.
H. L. Peiler & Co., Montreal.
W. J. Wall, Montreal.
Garlock Packing Co., Hamilton, Ont.
Lunkenheimer Co., Cincinnati, O.

Gauges—Pressure, Vacuum, Draft and Recording.
Babcock & Wilcox, Montreal.
Lunkenheimer Co., Cincinnati, O.
H. L. Peiler & Co., Montreal.

Gauges, Water.
Jenkins Bros., Ltd., Montreal.
The Lunkenheimer Co., Cincinnati, O.

Gears, Cut, Worm, Mortise.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart-Turner Machine Co., Ltd., Hamilton.
J. C. Wilson & Co., Glenora, Ont.

Gears, Spur Level.
Manitoba Bridge & Iron Works Limited, Winnipeg.
J. C. Wilson & Co., Glenora, Ont.

Generators.
W. H. Allen Son & Co. Bedford, Eng.
Can. Fairbanks-Morse Co., Montreal.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.
Northern Electric & Mfg. Co., Limited, Montreal.

Governors, Water Wheel
W. H. Allen Son & Co. Bedford, Eng.
J. C. Wilson & Co., Glenora, Ont.

Graphite.
Jos. Dixon Crucible Co., Jersey City.
General Supply Co. of Canada, Ottawa
C. C. Snowdon, Calgary.

Graphitol.
British Pacific Supply Co., Victoria, B.C.

Grates.
Babcock & Wilcox, Montreal.
Ed. Bennis & Co., Ltd.
Boiler Repair & Grate Bar Co., Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Hare Eng. Co., Toronto.
H. L. Peiler & Co., Montreal.
Geo. H. Tod, Toronto.

Grease Cups.
Adams Cooks Son, New York.
Albany Lubricating Co., New York.
Detroit Lubricator Co., Walkerville.
General Supply Co. of Canada, Ottawa
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
Peterborough Machine & Lubricator Co., Ltd., Peterborough.
F. J. Schuch, Toronto.

Grease and Oil Extractors.
Canada Foundry Co., Ltd., Toronto.
Elliott Co., Pittsburgh, Pa.
C. C. Snowdon, Calgary.
Hare Eng. Co., Toronto.
Steam Appliance Co., Milwaukee, Wis.

Greases.
Adams Cooks Son, New York.
Albany Lubricating Co., New York.
British Pacific Supply Co., Victoria, B. C.
Can. Fairbanks-Morse Co., Montreal.
Can. Oil Companies, Ltd., Toronto.
Jos. Dixon Crucible Co., Jersey City.
C. C. Snowdon, Calgary.

Hangers.
Can. Bond Hanger & Coupling Co., Alexandria.
C. O. Bartlett & Snow Co., Montreal
Can. Fairbanks-Morse Co., Montreal.
Elmira Machinery and Transmission Co., Elmira.
General Supply Co. of Canada, Ottawa
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.
J. C. Wilson & Co., Glenora, Ont.

Heaters.
Alberger Condenser Co., New York.
Canada Foundry Co., Toronto.
Darling Bros., Montreal.
General Supply Co. of Canada, Ottawa
Goldie & McCulloch Co., Galt.
Hare Eng. Co., Toronto.
E. Leonard & Sons, London, Ont.
H. L. Peiler & Co., Montreal.
The Sims Co., Erie, Pa.

Hoists.
C. O. Bartlett & Snow Co., Montreal
Engineering Works of Canada, Ltd., Montreal.

Hose, Flexible Metallic.
F. J. Schuch, Toronto.

Hose, Steam, Suction and Water.
Dunlop Tire & Rubber Goods Co., Toronto.
Garlock Packing Co., Hamilton, Ont.

Hydraulic Accumulators.
Canada Foundry Co., Ltd., Toronto.
Smart - Turner Machine Co., Ltd., Hamilton.

Hydraulic Machinery.
W. H. Allen Son & Co. Bedford, Eng.
The Deming Co., Salem, O.
Engineering Works of Canada, Ltd., Montreal.
John McDongall Caledonian Iron Wks, Montreal.

Hydraulic Presses.
Bawdon Machine Co., Toronto.

Hydro Extractors.
Jones & Glassco, Montreal,

Ice Making Machinery.
Linde British Refrigeration Co., Montreal.

Indicators, Electric—All Types.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton

Indicators, Steam and Gas Engine.
Can. Fairbanks-Morse Co., Montreal.
H. L. Peiler & Co., Montreal.
The Maihak Indicator Agy., Montreal.

Indicators—Ammonia, Hydraulic.
Detroit Lubricator Co., Walkerville.

Indicating.
Renown Engine & Machine Co., Montreal.

Injectors.
General Supply Co. of Canada, Ottawa
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
Penberthy Injector Co., Windsor.

Insulating Compounds.
Standard Underground Cable Co., of Canada, Ltd., Hamilton, Ont.

Insulating Tapes & Varnishes.
Standard Underground Cable Co., of Canada, Ltd., Hamilton, Ont.

Furnaces.
Monarch Electric Co., St. Lambert, Que.

Iron Filler.
Imperial Waste & Metal Co., Montreal.

Lamps, Tungsten, etc.
Canadian General Electric Co., Ltd., Toronto.

Lamps, Arc, Incandescent.
Canadian General Electric Co., Ltd., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Canadian Westinghouse Co., Hamilton
P. H. Klein, Jr., Co., Montreal.
Northern Electric & Mfg. Co., Limited, Montreal.
A. H. Winter Joyner, Toronto.

Lubricants.
Adams Cooks Son, New York.
Albany Lubricating Co., New York.
British Pacific Supply Co., Victoria,
Can. Oil Companies, Ltd., Toronto.
Jos. Dixon Crucible Co., Jersey City.
C. C. Snowdon, Calgary.

Lubricators, Force Feed.
Adams Cooks Son, New York.
Albany Lubricating Co., New York.
Darling Bros., Montreal.
Can. Detroit Lubricator Co., Windsor,
General Supply Co. of Canada, Ottawa
Lunkenheimer Co., Cincinnati, O.
Manzel Bros. Co., Buffalo, N.Y.
Peterborough Machine & Lubricator Co., Ltd., Peterborough.

Lubricators, Plain.
Can. Detroit Lubricator Co., Windsor, Ont.
General Supply Co. of Canada, Ottawa
Lunkenheimer Co., Cincinnati, O.

Mats—Rubber, Steel.
Dunlop Tire & Rubber Goods Co., Toronto.
Kuhne-Anderton Mfg. Co., Port Hope, Ont.

Mechanical Stokers.
Babcock & Wilcox, Montreal.
Ed. Bennis & Co., Ltd.
Fraser & Chalmers, Ltd., Montreal.
Hare Eng. Co., Toronto.
Jones Underfeed Stoker Co., Toronto.
Murphy Iron Works, Detroit, Mich.
Geo. H. Tod, Toronto.

Metal Cutting (Oxy-Hydrogen).
Franco-Can. Welding Co., Toronto.

Metal Welding.
Franco-Can. Welding Co., Toronto.

Meters, Electric.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Monarch Electric Co., St. Lambert, Que.

Meters, Water.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
H. L. Peiler & Co., Montreal.

Mica.
Kent Brothers, Kingston, Ont.

Mill and Mining Machinery.
W. H. Allen Son & Co. Bedford, Eng.
Can. Fairbanks-Morse Co., Montreal.
Engineering Works of Canada, Ltd., Montreal.
Fraser & Chalmers, Ltd., Montreal.
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co. Sherbrooke, Que
Robb Engineering Co., Amherst, N.S.
Railway Equipment Co., Toronto.
Waterous Engine Works Co., Brantford.
J. C. Wilson & Co., Glenora, Ont.

Molds, Rubber.
Bawdon Machine Co., Toronto.

Motors.
W. H. Allen Son & Co. Bedford, Eng.
Can. Fairbanks-Morse Co., Montreal.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.
Northern Electric & Mfg. Co., Limited, Montreal.
Railway Equipment Co., Toronto.

Motor Starters and Controllers.
W. H. Allen Son & Co. Bedford, Eng.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.

Office Railings.
Jas. Morrison Brass Mfg. Co., Toronto.

Oil Cups.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.

Oiler Compound Feeders.
Lunkenheimer Co., Cincinnati, O.

Oilers, Gauge.
Lunkenheimer Co., Cincinnati, O.

Oilers, Multiple.
Can. Detroit Lubricator Co., Windsor.
Lunkenheimer Co., Cincinnati, O.

Oil Filters & Circulating Systems.
S. F. Bowser & Co., Inc., Toronto.
Darling Bros., Montreal.
Elliott Co., Pittsburgh, Pa.
General Supply Co. of Canada, Ottawa
Jas. Morrison Brass Mfg. Co., Toronto.
The Sims Co., Erie, Pa.

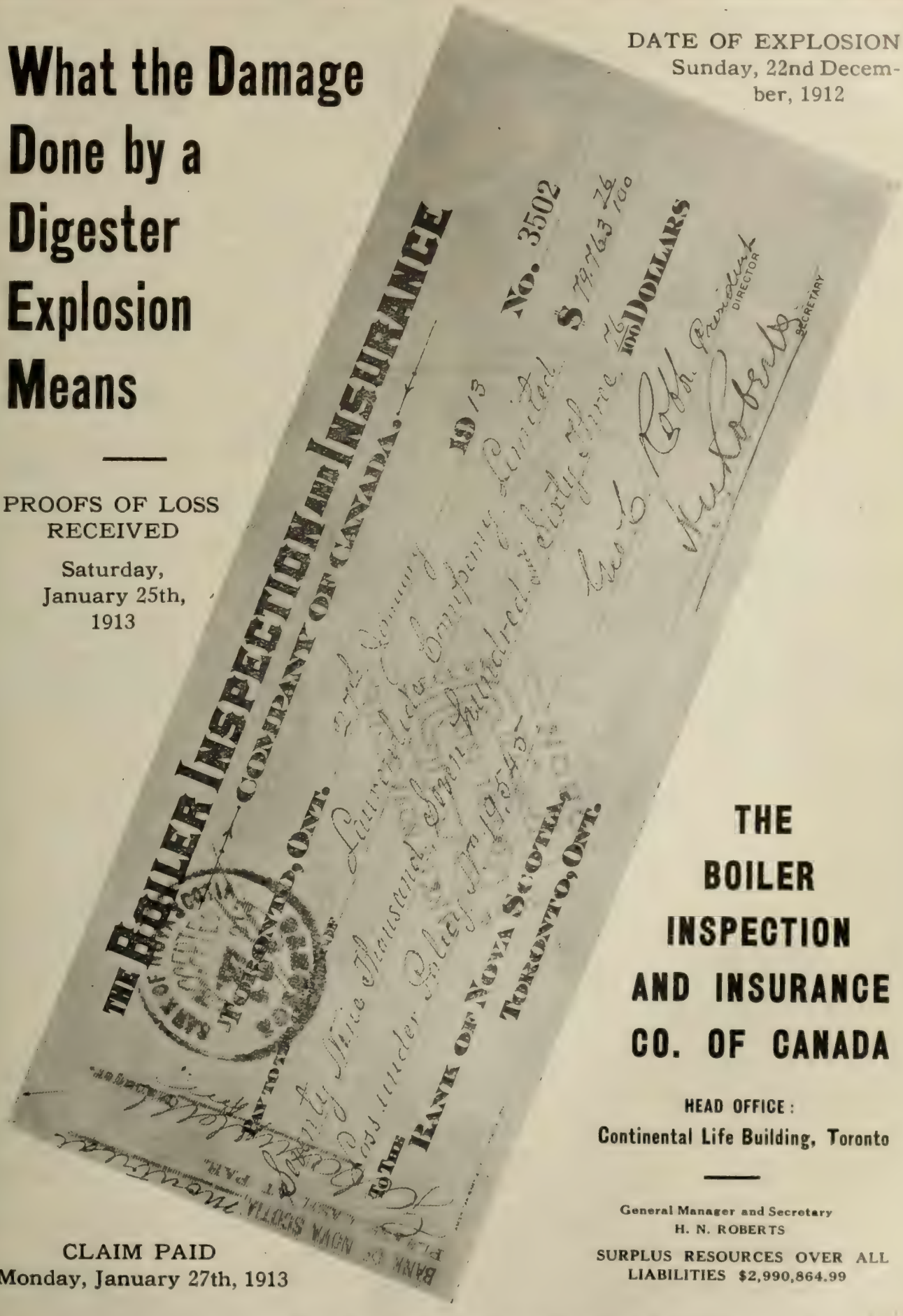
Oil Separators, Ammonia.
Steam Appliance Co., Milwaukee.

What the Damage Done by a Digester Explosion Means

PROOFS OF LOSS RECEIVED

Saturday, January 25th, 1913

DATE OF EXPLOSION
Sunday, 22nd December, 1912



CLAIM PAID
Monday, January 27th, 1913

THE BOILER INSPECTION AND INSURANCE CO. OF CANADA

HEAD OFFICE:
Continental Life Building, Toronto

General Manager and Secretary
H. N. ROBERTS

SURPLUS RESOURCES OVER ALL LIABILITIES $2,990,864.99

The advertiser would like to know where you saw his advertisement—tell him.

Oil Separators.
Babcock & Wilcox, Montreal.
Can. Fairbanks-Morse Co., Montreal.
Canada Foundry Co., Ltd., Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
C. A. Dunham Co., Toronto.
Elliott Co., Pittsburgh, Pa.
General Supply Co. of Canada, Ottawa
Hare Eng. Co., Toronto.
Liberty Mfg. Co., Pittsburg.
Jas. Morrison Brass Mfg. Co., Toronto.
Smart - Turner Machine Co., Ltd., Hamilton.
Steam Appliance Co., Milwaukee

Oiling Systems.
S. F. Bowser & Co., Inc., Toronto.

Oils, Lubricating.
Adams Cooks Son, New York.
Albany Lubricating Co., New York.
British Pacific Supply Co., Victoria
Can. Oil Companies, Ltd., Toronto.
Dearborn Chemical Co., Chicago.
C. C. Snowdon, Calgary.

Oxy-Acetylene Welding.
Franco-Can. Welding Co., Toronto

Packing Engine.
Can. H. W. Johns-Manville Co., Toronto.
Dunlop Tire & Rubber Goods Co., Toronto.
Garlock Packing Co., Hamilton, Ont.
General Supply Co. of Canada, Ottawa
Steel Mill Packing Co., Windsor, Ont.

Packing, Metallic.
General Supply Co. of Canada, Ottawa
Holmes Metallic Packing Co., Wilkesbarre, Pa.
H. L. Peller & Co., Montreal.
Quaker City Rubber Co., Philadelphia, Pa.
Rhodes Improved Metallic Packing Co., Ltd., Montreal.
Steel Mill Packing Co., Windsor, Ont.

Packing, Rod.
Goetze-Gasket & Packing Co., New Brunswick, N.J.
Canadian H. W. Johns-Manville Co. Ltd., Toronto.
Dunlop Tire & Rubber Goods Co., Toronto.
Garlock Packing Co., Hamilton, Can.
General Supply Co. of Canada, Ottawa
Steel Mill Packing Co., Windsor, Ont

Packing, Sheet.
Dunlop Tire & Rubber Gods Co., Toronto.
Garlock Packing Co., Hamilton, Can.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.
General Supply Co. of Canada, Ottawa
Jenkins Bros., Ltd., Montreal.
Quaker City Rubber Co., Philadelphia, Pa.
F. J. Schuch, Toronto.

Packing, Ammonia, Steam and Water.
Canadian H. W. Johns-Mansville Co., Toronto.
Dunlop Tire and Rubber Goods Co., Toronto.
Garlock Packing Co., Hamilton, Can.
General Supply Co. of Canada, Ottawa
Quaker City Rubber Co., Philadelphia, Pa.
F. J. Schuch, Toronto.
Steel Mill Packing Co., Windsor, Ont.

Packing, Rubber.
Dunlop Tire and Rubber Goods Co., Toronto.

Panel Boards.
Devoe Electric Switch Co., Montreal.
Hill Electric Switch Co., Montreal.

Packing Rubber.
Dunlop Tire and Rubber Goods Co., Toronto.

Patents.
Rowland Brittain, Vancouver, B.C.

Penstocks.
Canada Foundry Co., Ltd., Toronto.
Canadian Booving Co., Toronto.

Penstock Lugs.
Otterville Mfg. Co., Otterville, Ont.

Pillow Blocks.
Can. Bond Hanger & Coupling Co., Alexandria.
Elmira Machinery & Transmission Co., Elmira, Ont.
J. C. Wilson & Co., Glenora, Ont.

Pipe Coils.
National Pipe Bending Co., New Haven, Conn.

Pipe Cutting and Treading Machine and Tools.
Can. Fairbanks-Morse Co., Montreal.
Curtis & Curtis Co., Bridgeport, Conn

Pipe, Steel.
Canada Foundry Co., Ltd., Toronto.
Canadian Boving Co., Toronto.
E. Leonard & Sons, London, Ont.

Pipe (Second-Hand).
Imperial Waste & Metal Co., Montreal.

Pipes, Water.
Canada Foundry Co., Ltd., Toronto.
Canadian Boving Co., Toronto.
Pacific Coast Pipe Co., Vancouver, B. C.

Piping and Fittings.
Jas. Morrison Brass Mfg. Co., Toronto.

Piping, Steam.
Babcock & Wilcox, Montreal.
Imperial Waste & Metal Co., Montreal.

Planimeters.
H. L. Peller & Co., Montreal.

Plate Work.
Canada Foundry Co., Ltd., Toronto.
Fraser & Chalmers, Ltd., Montreal.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

Plumbing Machinery.
Chicago Pump Co., Chicago, Ill.

Polish, Metal.
G. W. Hoffman, Indianapolis.

Power Pumps.
W. H. Allen Son & Co. Bedford, Eng.
American Steam Pump Co., Battle Creek, Mich.
Canadian Boving Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Canada Foundry Co., Ltd., Toronto.
Darling Bros., Montreal.
Deming Co., Salem, O.
General Supply Co. of Canada, Ottawa
Goldie & McCulloch Co., Galt.
Goulds Pump Co., Montreal.
E. Leonard & Sons, London, Ont.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.
Waterous Engine Works Co., Brantford.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.
Dunlop Tire & Rubber Goods Co., Toronto.
Garlock Packing Co., Hamilton, Can.

Power Transmission Machinery.
Can. Fairbanks-Morse Co., Montreal.
Elmira Machinery & Transmission Co., Elmira, Ont.
Engineering Works of Canada, Ltd., Montreal.
General Supply Co. of Canada, Ottawa
Goldie & McCulloch Co., Galt.
Jeffrey Manufacturing Co., Columbus.
Jenckes Machine Co., Sherbrooke, Que.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Waterous Engine Works Co., Brantford.
J. C. Wilson & Co., Glenora, Ont.

Pulleys.
C. O. Bartlett & Snow Co., Montreal
Can. Fairbanks-Morse Co., Montreal.
Crescent Oil Co., Hamilton, Ont.
Elmira Machinery and Transmission Co., Elmira, Ont.
General Supply Co. of Canada, Ottawa
Jeffrey Manufacturing Co., Columbus.
Manitoba Bridge & Iron Works Limited, Winnipeg.
Waterous Engine Works Co., Brantford.
J. C. Wilson & Co., Glenora, Ont.

Pulp Mill Machinery.
W. H. Allen Son & Co. Bedford, Eng.
Escher, Wyss & Co., Toronto.
Jeffrey Manufacturing Co., Columbus.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford.

Pumping Machinery.
W. H. Allen Son & Co. Bedford, Eng.
American Steam Pump Co., Battle Creek, Mich.
Canadian Boving Co., Toronto.
Canada Fdry Co., Ltd., Toronto.
Deming Co., Salem, O.
General Supply Co. of Canada, Ottawa
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.
Standard Eng. Co., Toronto.
Waterous Engine Works Co., Brantford.

Pumping Machinery, Electrical.
W. H. Allen Son & Co. Bedford, Eng.
Chicago Pump Co., Chicago, Ill.
Jeffrey Manufacturing Co., Columbus.

Pump Governors and Regulators.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
C. A. Dunham Co., Toronto.
G. M. Davis Regulator Co., Chicago, Ill.
Elliott Co., Pittsburgh, Pa.
General Supply Co. of Canada, Ottawa
Hare Eng. Co., Toronto.
H. L. Peller & Co., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.
Watson & McDaniel Co., Philadelphia.

Pump Strainers.
Canadian Steam Boiler Equipment Co., Toronto.
Liberty Mfg. Co., Pittsburgh, Pa.

Pumps, Air.
W. H. Allen Son & Co. Bedford, Eng.
American Steam Pump Co., Battle Creek, Mich.
Canadian Boving Co., Toronto.
Canada Foundry Co., Ltd., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Deming Co., Salem, O.
General Supply Co. of Canada, Ottawa
E. Leonard & Sons, London, Ont.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.

Pumps, Hand and Power.
S. F. Bowser & Co., Inc., Toronto.

Pumps, Centrifugal.
W. H. Allen Son & Co. Bedford, Eng.
Alberger Condenser Co., New York
A. W. Bennet, Toronto.
Canada Foundry Co., Ltd., Toronto.
Canadian Boving Co., Toronto.
Engineering Works of Canada, Ltd., Montreal.
Deming Co., Salem, O.
Canadian Boving Co., Toronto.
Escher, Wyss & Co., Toronto.
General Supply Co. of Canada, Ottawa
Hare Eng. Co., Toronto.
E. Leonard & Sons, London, Ont.
John McDougall Caledonian Iron Wks. Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.
Waterous Engine Works Co., Brantford.

Pumps, Geared, Compound.
American Steam Pump Co., Battle Creek, Mich.
Canada Foundry Co., Ltd., Toronto.
Deming Co., Salem, O.
Can. Fairbanks-Morse Co., Montreal.
E. Leonard & Sons, London, Ont.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.

Pumps, Hydraulic, Pressure.
American Steam Pump Co., Battle Creek, Mich.
Canada Foundry Co., Ltd., Toronto.
The Deming Co., Salem, O.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.

Pumps, Oil.
S. F. Bowser & Co., Inc., Toronto.
The Deming Co., Salem, O.
Detroit Lubricator Co., Walkerville.
Lunkenheimer Co., Cincinnati, O.
Manzel Cros. Co., Buffalo, N.Y.
Michigan Lubricator Co., Detroit.
Smart - Turner Machine Co., Ltd., Hamilton.

Pumps, Steam.
W. H. Allen Son & Co. Bedford, Eng.
American Steam Pump Co., Battle Creek, Mich.
Bawdon Machine Co., Toronto.
S. F. Bowser & Co., Inc., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Canada Foundry Co., Ltd., Toronto.
Darling Bros., Montreal.
The Deming Co., Salem, O.
C. A. Dunham Co., Toronto.
General Machinery Co., Toronto.
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.

Pumps, Vacuum.
W. H. Allen Son & Co. Bedford, Eng.
Alberger Condenser Co., New York.
American Steam Pump Co., Battle Creek, Mich.
Canadian Boving Co., Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Hare Eng. Co., Toronto.
C. A. Dunham Co., Toronto.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.

Pump Tank, Receiver.
American Steam Pump Co., Battle Creek, Mich.
Canada Fdry. Co., Ltd., Toronto.

Pyrometers.
Jas. Morrison Brass Mfg. Co., Toronto.

Rails (Relaying).
Imperial Waste & Metal Co., Montreal

Radiator Air Vents.
Jas. Morrison Brass Mfg. Co., Toronto.

Refrigerator Doors, Windows, Etc.
Jones Cold Store Door Co., Hagerstown, Ind.

Refrigerating Engineers.
Arctic Ice Making Co., Canton, O.
Chas. Bishop, Montreal.

Refrigeration Machinery.
International Marine Signal Co., Ottawa.
Linde British Refrigeration Co., Montreal.
Linde Can. Refrigeration Co., Montreal.
Vilter Mfg. Co., Milwaukee, Wis.

Reducing Wheels.
H. L. Peller & Co., Montreal.

Regulators, Pressure.
C. A. Dunham Co., Toronto.
Jas. Morrison Brass Mfg. Co., Toronto.
Ohio Brass Co., Mansfield, Ohio.
The Sims Co., Erie, Pa.

Revolving Doors for Hardening Rooms.
Jones Cold Store Door Co., Hagerstown, Md.

Revolution Counters.
Maihak Indicator Agency, Montreal.
Schuchardt & Schutte, Montreal.

Rheostats.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co. Hamilton.

Roofings—Asbestos and Wool Felts
Canadian H. W. Johns-Manville Co., Ltd., Toronto.

Rope Preservative.
Cling Surface Co., Buffalo.

Rotary Converters.
Can. Fairbanks-Morse Co., Montreal.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton

Rubber Hose.
Dunlop Tire & Rubber Goods Co., Toronto.
Garlock Packing Co., Hamilton, Ont.
General Supply Co. of Can., Ottawa.
Liberty Mfg. Co., Pittsburg, Pa.
Quaker City Rubber Co., Philadelphia.

Rubber Specialties.
Dunlop Tire & Rubber Goods Co., Toronto.

Safes.
Can. Fairbanks-Morse Co., Montreal.
Goldie & McCulloch Co., Galt.

Safety Valves.
Can. Fairbanks-Morse Co., Montreal.
General Supply Co. of Canada, Ottawa
Lunkenheimer Co., Cincinnati, O.
H. L. Peller & Co., Montreal.

Screens.
C. O. Bartlett & Snow Co., Montreal

Shafting.
C. O. Bartlett & Snow Co., Montreal
Elmira Machinery and Transmission Co., Elmira.
General Supply Co. of Canada, Ottawa
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Manitoba Bridge & Iron Works, Ltd., Winnipeg.
Waterous Engine Wks. Co., Brantford
J. C. Wilson & Co., Glenora, Ont.

Shaking and Dumping Grates.
Babcock & Wilcox, Montreal.
Can. Steam Boiler Equipment Co., Toronto.
Hare Eng. Co., Toronto.
Waterous Engine Wks. Co., Brantford

Smoke Consumers.
Canadian Steam Boiler Equipment Co., Toronto.

Smoke Boxes, Stacks.
Babcock & Wilcox, Montreal.
Canada Fdry. Co., Ltd., Toronto.
E. Leonard & Sons, London, Ont.
Waterous Engine Wks. Co., Brantford

Smokeless Furnaces.
Jones Underfeed Stoker Co., Toronto.
Murphy Iron Wks. ,Detroit, Mich.
Geo. H. Tod, Manning Chambers, Toronto.

Soot Cleaners.
Vulcan Tube Cleaning Systems, Ltd., Montreal.

Special Machinery.
W. H. Allen Son & Co. Bedford, Eng.
Can. Fairbanks-Morse Co., Montreal.
Waterous Engine Wks. Co., Brantford
J. C. Wilson & Co., Glenora, Ont.

Sprocket Chain Attachments.
C. O. Bartlett & Snow Co., Montreal
Manitoba Bridge & Iron Works, Ltd., Winnipeg.
Waterous Engine Wks. Co., Brantford

Spur Wheels.
Can. Fairbanks-Morse Co., Montreal.
Waterous Engine Wks. Co., Brantford
J. C. Wilson & Co., Glenora, Ont.

Stand Pipes, Steel.
Canada Fdry. Co., Ltd., Toronto.

Steam Separators.
Can. Fairbanks-Morse Co., Montreal.
Canada Foundry Co., Ltd., Toronto.
Darling Bros., Montreal.
C. A. Dunham Co., Toronto.
Elliott Co., Pittsburgh, Pa.
General Supply Co. of Canada, Ottawa
Hare Eng. Co., Toronto.
H. L. Peller & Co., Montreal.
The Sims Co., Erie, Pa.
Smart - Turner Machine Co., Ltd., Hamilton.
Steam Appliance Co., Milwaukee.
Watson & McDaniel Co. Philadelphia
Montreal.

Steam Specialties.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundry Co., Ltd., Toronto.
Darling Bros., Montreal.
C. A. Dunham Co., Toronto.
General Supply Co. of Canada, Ottawa
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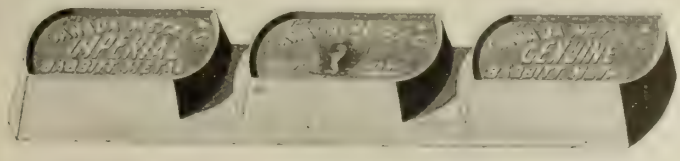

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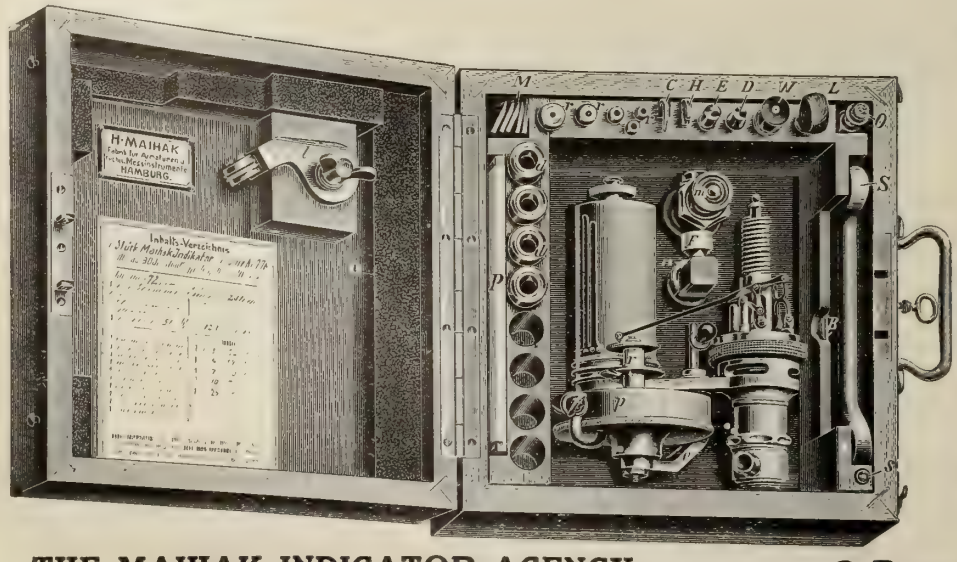

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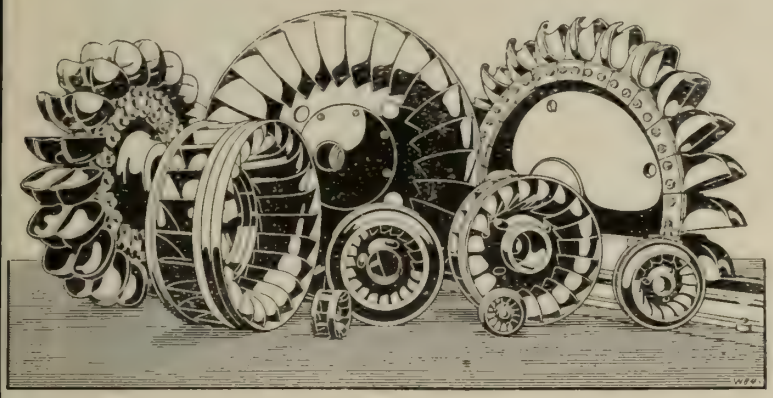

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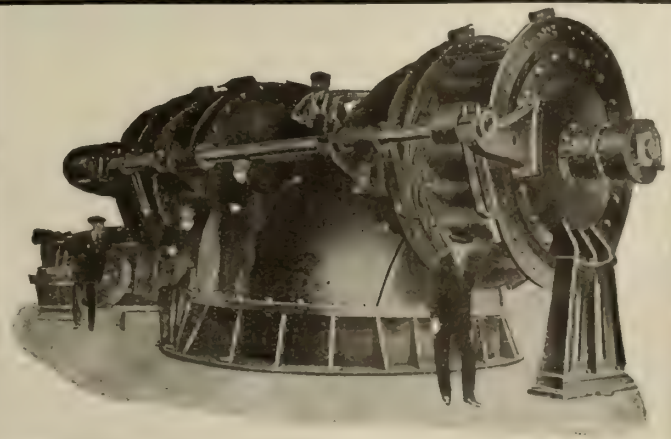

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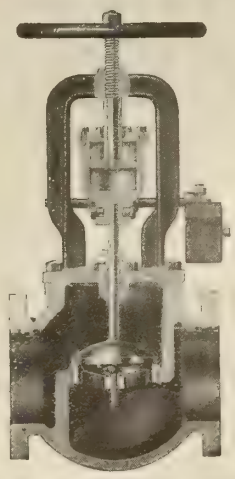

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Globe and Angle Patterns with Renewable and Regrinding Seat and Disc.

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No matter what its cost may be, if there is any chance that it may not always work you might as well keep your money in your pocket.

Equip your boilers with

THE DAVIS CLASS C STOP AND CHECK OR NON-RETURN VALVE

and you may be sure of absolute protection from serious boiler accidents due to internal rupture. This automatic valve acts instantly when a reverse flow of steam occurs, and cuts out the disabled boiler from the battery.

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Jobbers and dealers everywhere sell Davis Valve Specialties.

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Established 1875

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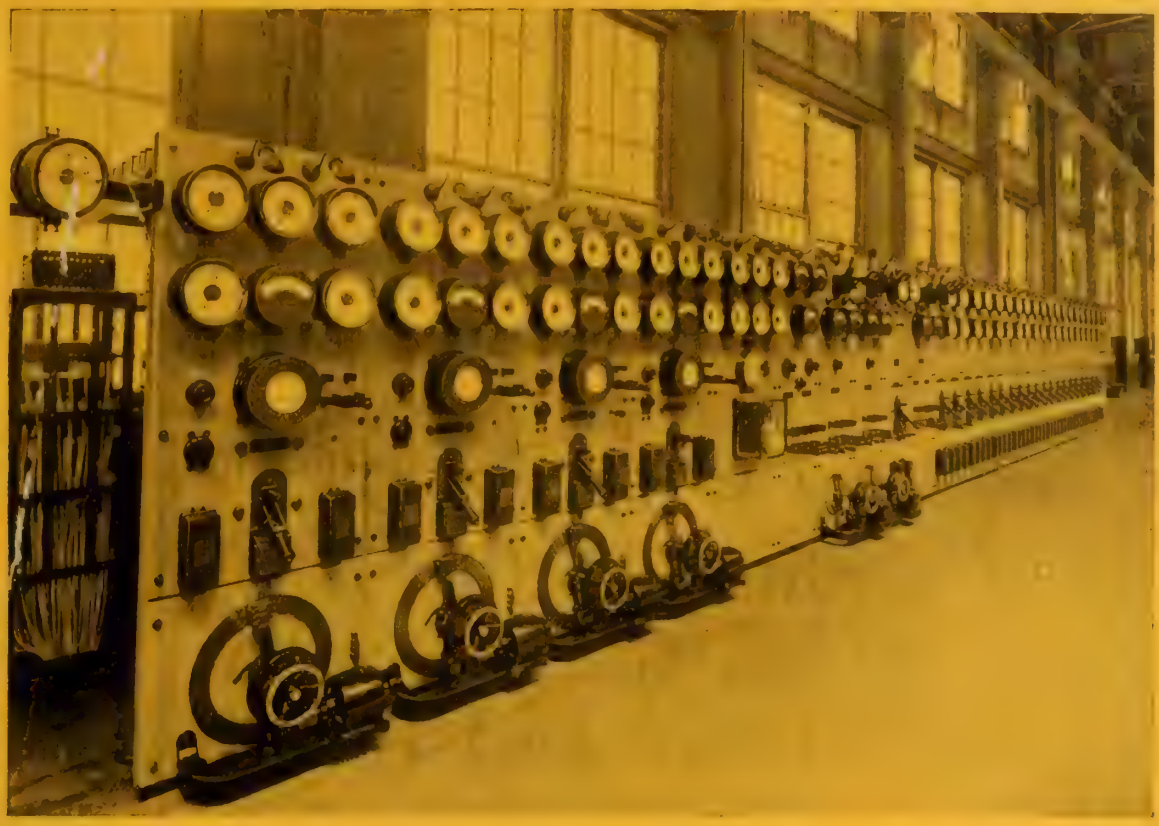

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THIS 21 panel board is a good example of the harmonious appearance of—

Westinghouse Switchboards

Our facilities for serving our customers are unsurpassed. The same careful attention is given to the construction of a single-panel board as to those consisting of many panels. These switchboards are designed and built in our own works from start to finish. Each individual detail is made by an expert and the board assembled complete on the floor before shipment, by men who for years have made a specialty of this kind of work, thus eliminating erection troubles at destination.

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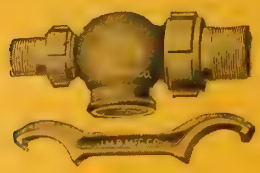
J. M. T. Valve.



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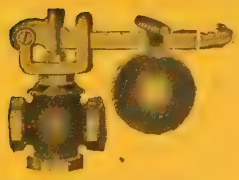
STEAM COCKS
J. M. T. Standard

Genuine
Hancock Inspirator.



Safety Valve—Lever
and Weight Type.

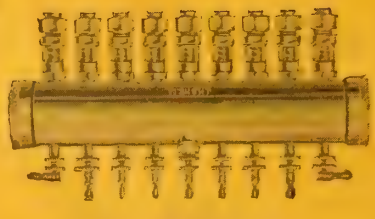
Steam and
Oil Separator.

Check Valve
with Drip Cock.

J. M. T.
SWING CHECK VALVES
Adjustable lift.

J. M. T. INJECTOR
(improved)

Relief Valve.



J. M. T. Multiple Oiler.

Oil Cup—Quick
Stop, Sight Feed

Steam
Whistle

Gauge Cock
Brass Wheel Handle.

TRADE MARK J.M.T. REGISTERED
A GUARANTEE OF QUALITY

Highest Quality

ENGINEERS' SUPPLIES, BRASS GOODS, PIPE FITTINGS AND TOOLS

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We have built a reputation for quality, and it is our aim to maintain it at all costs.

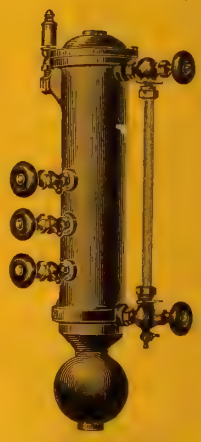
All inquiries will be given our prompt and careful attention.

Drop us a card to-day for particulars regarding lines in which interested.

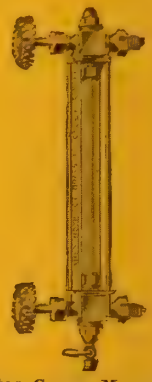
The James Morrison Brass Mfg. Co., Ltd.

93-97 Adelaide Street West **TORONTO**

Forked Lever
Air Cock



Water Column
with high and low whistle
Alarm.



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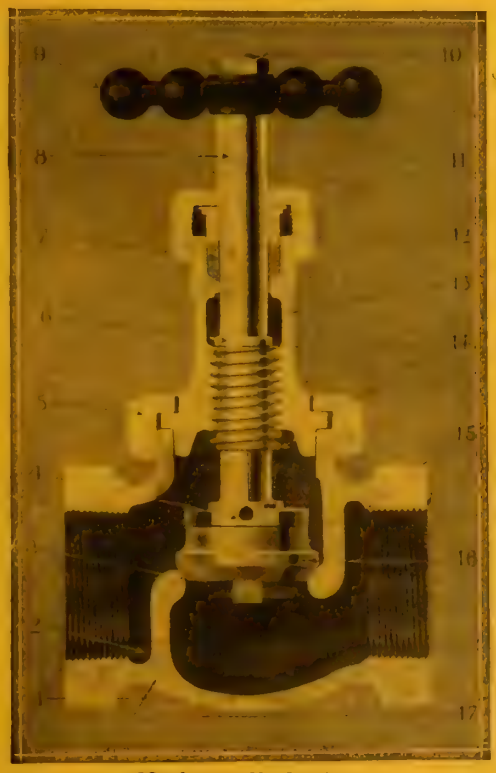
"ALL QUALITY" REGRINDING BRASS VALVES

If you use valves, you cannot afford to use anything but the very best. PENBERTHY REGRINDING "ALL QUALITY" VALVES are the best valves on the market because they have been designed to give satisfactory service on the most severe conditions. So the simplicity of the regrinding feature in our valves will be appreciated, we illustrate same below.

QUICKER—SIMPLER and CHEAPER than renewing Discs isn't it? The seat in body of valve, also seat on disc ground together in one operation, not necessary to remove from the pipe line. If you once used them, you would use no other. A trial will convince you. For satisfactory valve service specify

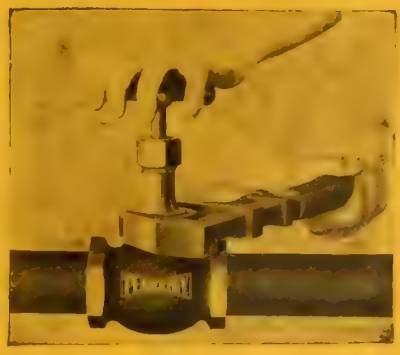
"ALL QUALITY" PENBERTHY REGRINDING BRASS VALVES

INTERIOR VIEW



Mechanically Perfect
200 lbs. Continuous Pressure

FIRST



Removing Union Ring

SECOND

Applying Oil and Emery

THIRD

Inserting Pin

FOURTH

Regrinding

MANUFACTURED BY

Penberthy Injector Co., Limited **Windsor, Ont.**

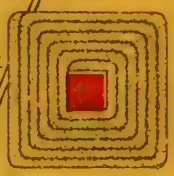
WE ALWAYS KEEP IN LINE WITH THE IMPROVEMENTS OF THE AGE

FROM THE GENERATION OF STEAM TO THE LAST WORD IN STEAM MAKING APPLIANCES, NOTHING HAS BEEN MADE SO NEAR PERFECTION AS **RAIN-BESTO** PACKINGS FOR PISTONS OF HIGH SPEED ENGINES.

PAPIN'S COFFEE POT THE ORIGIN OF THE ENGINE

STYLE C

RAIN-BESTO SPIRAL PACKINGS



STYLE B

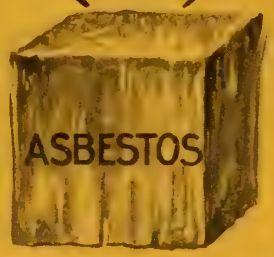
MADE OF

STYLE A

THE FINEST MATERIALS

STYLE E

A COMBINATION OF THE BEST LONG FIBROUS ASBESTOS CLOTH MADE AND A CORE OR CUSHION OF THE CELEBRATED **RAINBOW PACKING** COMPOUND IS UNEQUALLED FOR EXTREMELY HIGH PRESSURES.



ASBESTOS

PEERLESS RUBBER MANUFACTURING CO.

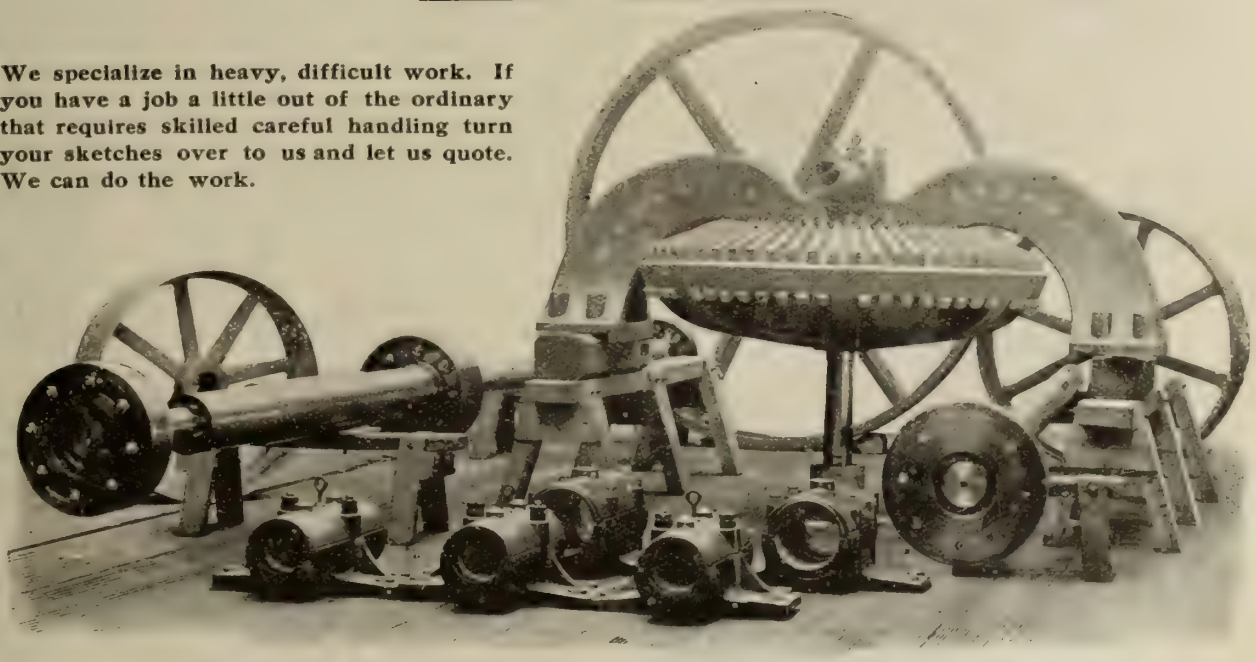
16 WARREN STREET, NEW YORK

FOR SALE EVERYWHERE

TRANSMISSION MACHINERY

ALL KINDS

We specialize in heavy, difficult work. If you have a job a little out of the ordinary that requires skilled careful handling turn your sketches over to us and let us quote. We can do the work.



UP-TO-DATE equipment throughout our shops permits us to turn out a high-grade product at a fair price.

Designs are modern, all materials used are of the best, every piece is guaranteed as to workmanship.

Almost 70 years' experience in providing power transmissions for mills, factories and power plants of every description is behind the machinery we are selling to-day. *There is more than a promise of quality in this.*

KEPT IN STOCK FOR PROMPT SHIPMENT

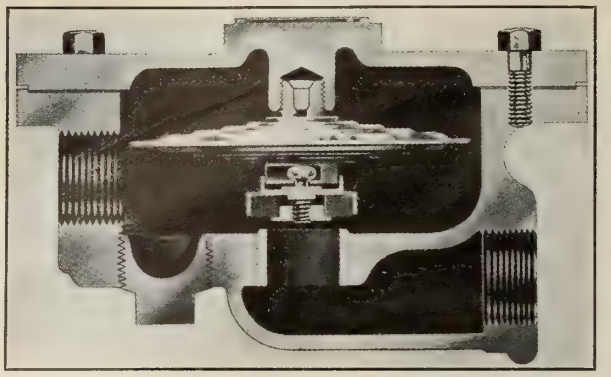
SHAFTING.
COUPLINGS.
IRON PULLEYS.
ROPE SHEAVES.
GEARING, ALL KINDS.
HANGERS.
BEARINGS.
PILLOW BLOCKS.
BRACKETS.
BELT TIGHTENERS.
FRICTION CLUTCHES.

THE WATEROUS ENGINE WORKS CO., LTD.

BRANTFORD, CANADA

The advertiser would like to know where you saw his advertisement—tell him.

The Dunham Blast Trap passes more water and saves more steam for its size than any trap on the market to-day.



DUNHAM BLAST TRAP

Let us prove it to You

Ask About It

Especially adapted for use on all large heating units, such as blast, tempering and reheating coils, heating units for lumber kilns, etc. Can be used on low pressure system and discharge to vacuum pump or sewer.

If you have any heating problems, put them up to our Engineering Department. It will cost you nothing.

C. A. DUNHAM CO., Ltd. TORONTO, CAN.

Halifax Montreal Vancouver Calgary Edmonton

Sales Over Five Million Dollars Annually

Four Babbitt Manufacturing Plants

TORONTO LONDON, ENG. NEW YORK ST. LOUIS

Faultless "A" This babbitt is a high grade copper hardened alloy, possessing in a higher degree all the good points of the original Genuine Babbitt, with increased antifriction qualities, having the additional merit of absorbing and holding oil. It is used extensively in France for automobile engines, and in South Africa for mining machinery, and in United States and Canada for marine engines, dynamos and all heavy duty machines. Where heavy service is required this will last longer than any Genuine Babbitt manufactured. For heavy duty, saw mills and engines it is without equal.

Eagle "A" Thousands of tons of this alloy have been placed on the market, giving such perfect results, that it's name and merits are known, we believe, as extensively as any other babbitt manufactured. Its high antifriction and heavy duty qualities make it especially adapted for saw-mills, planing-mills, threshing engines, traction engines, pumps, rolling-mills and general machine shop use.

HOYT METAL COMPANY

TORONTO OFFICE AND MFG. PLANT—EASTERN AVE. AND LEWIS ST.

The advertiser would like to know where you saw his advertisement—tell him.

JENCKES BOILERS

HORIZONTAL TUBULAR
VERTICAL TUBULAR

LOCOMOTIVE TYPES
HEATING BOILERS

"The Efficient, Durable and Economical Kind."

The construction of our boilers is carried out with scrupulous care at every step.

Our manufacturing facilities enable us to produce the **highest grade Boilers at a very reasonable price.** We have won a reputation for quality to maintain which no pains are spared.

Every "Jenckes" Boiler is tested under high pressure before leaving our plant.

This is our Boiler Department with boilers in various stages of construction.
We turn out Boilers to conform with the various Provincial Inspection Acts. An assorted stock on hand constantly.

Write for descriptive catalog.

The Jenckes Machine Co., Limited

Sherbrooke Montreal St. Catharines Cobalt South Porcupine Nelson Vancouver

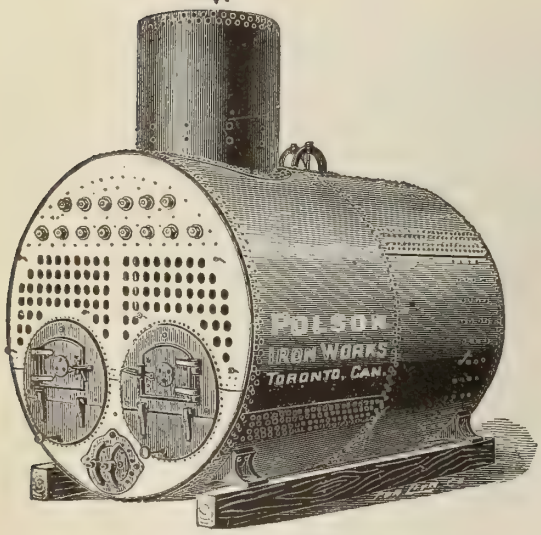
Works: SHERBROOKE, QUE. ST. CATHARINES, ONT.

MARINE BOILERS

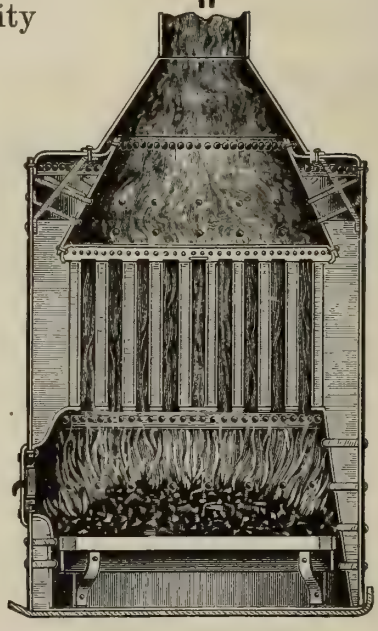
LAND BOILERS

The Utmost in Boiler Efficiency

From start to finish these boilers are under the supervision of experts, and are made by men with long experience. Only the best materials are used, so as to ensure a boiler of unusual durability and safety.



It will pay you to communicate with us and get full particulars. You may need a new boiler soon, and you will want the best.



We build various types:

Scotch, Clyde, Fitzgibbon, Vertical, Mosher.

Horizontal Tubular, Vertical, Locomotive Type, "Heine" Water Tube

GENERAL PLATE WORK

POLSON IRON WORKS, LIMITED

STEEL SHIPBUILDERS, ENGINEERS AND BOILERMAKERS

TORONTO **CANADA**

REPRESENTATIVES IN CANADA FOR

The B. F. Sturtevant Co., Hyde Park, Mass., U.S.A., Fans, Blowers, Heating and Ventilating
The John I. Thornycroft Co., London, England, Marine Motors

The advertiser would like to know where you saw his advertisement—tell him.

BETTINGTON BOILERS

HOW MUCH DOES IT COST YOU FOR STEAM?

HOW MUCH FUEL REMAINS IN YOUR ASH?

HOW MUCH UNCONSUMED VOLATILE IS GOING UP YOUR STACK?

IF YOU ARE BURNING SLACK COAL ARE YOU OBTAINING THE MAXIMUM EVAPORATION FROM IT?

REASONS WHY THE BETTINGTON SYSTEM WILL CUT DOWN YOUR FUEL BILLS

1. Analysis of the ash shows no carbon.
2. Volatile is all consumed.
3. Cheap coal containing as high 35% ash can be burned with the highest efficiency.
4. Stand by losses eliminated.
5. The cheapest grades of coal can be used.
6. Less labor required.

Bettington Boilers in course of erection for Dominion Coal Co., Ltd.

OPERATING ADVANTAGES OF THE BETTINGTON SYSTEM

1. No grates.
2. No fires to clean.
3. Less ash to handle.
4. Fuel supply quickly adjusted to demand for steam.
5. No smoke.
6. No stand by boilers with banked fires necessary to take care of peak loads.
7. Full load can be obtained in 30 minutes from a cold boiler.

July 25/13
4 Cuts
Delivered
By W. Wells

THE BETTINGTON SYSTEM of burning pulverized fuel gives all the advantages of gas fired boilers, and 80% thermal efficiency with the cheapest fuel can be continuously obtained.

FRASER & CHALMERS

LIMITED

Canadian Branch:

4 PHILLIPS PLACE .:. MONTREAL, P.Q.

Valuable Boiler Information

FACTS BASED ON WORLD WIDE EXPERIENCE WITH WATER TREATMENTS AND SCALE DISSOLVENTS.

¶ A 100 H.P. Boiler evaporates 30,000 pounds in ten hours or 390 tons per month.

¶ In comparatively pure water there would be at least 88 pounds solid matter, and even in many kinds of spring water as much as 2,000 pounds.

¶ The presence of scale or sediment means burning and cracking of boilers, predisposition to explosions and loss of fuel in the following proportions: inch, 13%; ¼ inch, 38% and ½ inch 60%, saying nothing about repairs and loss of use of boilers.

¶ Compounds containing organic matter help rather than hinder incrustation.

¶ Compounds composed of bark and wood contain tannic acid which injures the metal.

¶ Molasses, fruits, etc., contain acetic acid, which is more injurious than tannic.

¶ Soda ash and alkalis dissolve scale, but also injure the metal, besides causing foaming if used excessively.

¶ Petroleum has been tried in certain waters, but crude oil helps to form scale, therefore the refined only is of any use.

¶ Tannate of soda has been partially successful in waters which do not contain sulphate.

¶ None of the above are effective where marshy or muddy water is used.

¶ These investigations have proved that the only right principle is a metal treatment, not a water treatment or scale dissolvent.

PEROLIN IS THE ONLY METAL TREATMENT

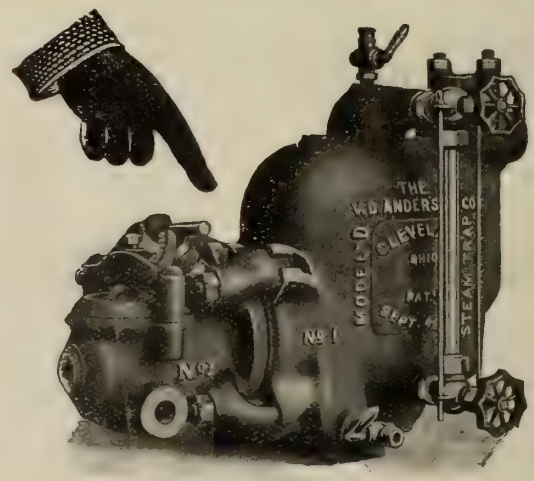
Let us prove its merits at our expense.

Dominion Specialties,
LIMITED

44 Adelaide St. West **TORONTO**

The Anderson Model "D" Steam Trap

An Efficient And Reliable Apparatus For Continuously Draining Condensed Water From Steam Coils, Jackets, Radiators, Etc.



Every part of this trap is designed with a view to continuous and reliable service.

The varying conditions under which a steam trap has to work calls for a wide range of valve openings in order to obtain the maximum capacity under high and low pressure.

The **Model "D" Trap** is so constructed that these conditions are met perfectly, both valve and valve seat can be changed from exhaust pressure to the highest boiler pressure, without breaking a steam joint or pipe connection.

A removable perforated strainer is part of the equipment, thus preventing pieces of scale, packing lead, etc., from entering the trap.

All parts of the **Model "D"** are interchangeable. **Every** part passes through a rigid system of inspection and testing before assembling.

Let us tell you more about the **Model "D."**

Write for descriptive booklet.

THE V. D. ANDERSON CO.

West 96th St., CLEVELAND, OHIO

BRANCH OFFICES: 330 Manhattan Building, Chicago, Ill.; 619 Park Bldg., Pittsburg, Pa.; 3 Arch St., Philadelphia, Pa.; 212 Walnut St., Cincinnati, Ohio; 207 Union Trust Building, Baltimore, Md.; 91 High Street, Boston, Mass.

POTATO SCALE

A Positive SCALE Remover

Absolutely Non-Injurious to Tubes, Etc.

BOILER CLEANSER

This is the most economical way to clean boiler tubes.

By putting a very small quantity in your feed water daily, you will keep your tubes perfectly clean.

This compound removes old scale in a short time and **prevents pitting, corrosion, foaming, etc.**

We embody no chemicals which are injurious to metal when preparing this boiler cleanser.

Send us a gallon of feed water and **we will mix a quantity for your approval.** If not satisfied **it will not cost you a cent.**

Numidian Cylinder Velox Engine Sliptivity Machine

Three Oils of Unexcelled Quality

Give Them a Trial ***Our Prices are Right***

C. C. SNOWDON

Refiner, Importer and Manufacturer of

Pennsylvania Lubricating and Refined Oils, Gasoline, Potato Scale Powder, Liquid Soap, Disinfectants, Polish, Waste, Oil Tanks, Etc.

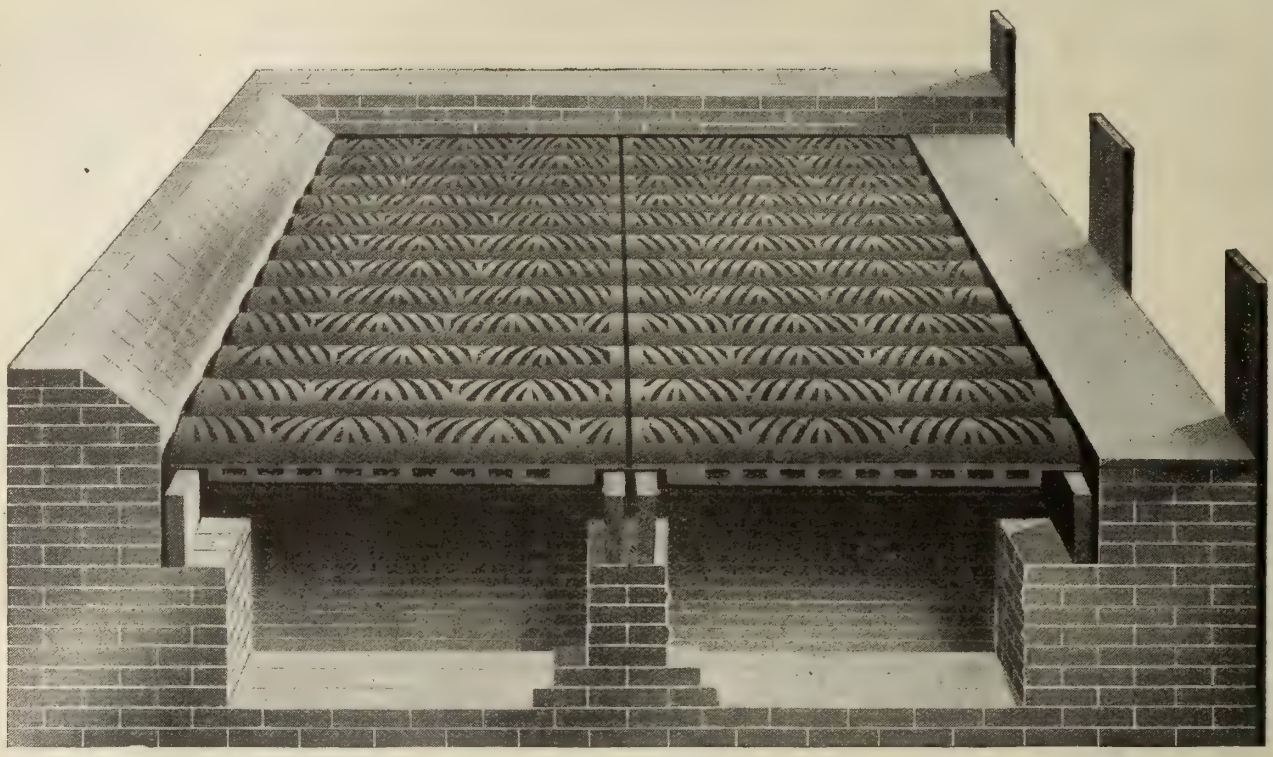
1810-1840 11th STREET EAST, CALGARY, ALBERTA

P. O. Box 1384

THOMAS ELLIPTIC GRATE BARS

SHAKING—CIRCLE—STATIONARY

FOR EVERY FUEL



THOMAS IDEAS

PATENTED

THOMAS ELLIPTIC GRATE BARS	INCREASE STEAM—SAVE FUEL—SAVE LABOR —COST LESS—REDUCE SMOKE.
THOMAS GRATE RESTS	EVERLASTING — PRESERVE GRATE BARS— PROTECT FIRE WALLS.
THOMAS FURNACE SETTING	FIRE WALLS—BRIDGE WALL—FRONT WALL independent of all expanding and contracting irons. SEE THAT AIR SPACE COMPLETELY ENCIRCLING THE GRATE AREA. No dead and burned grate bar ends. No pushed down walls from expansion of grates.

Shipped from Hamilton, Ont. **Let us give you complete information.**

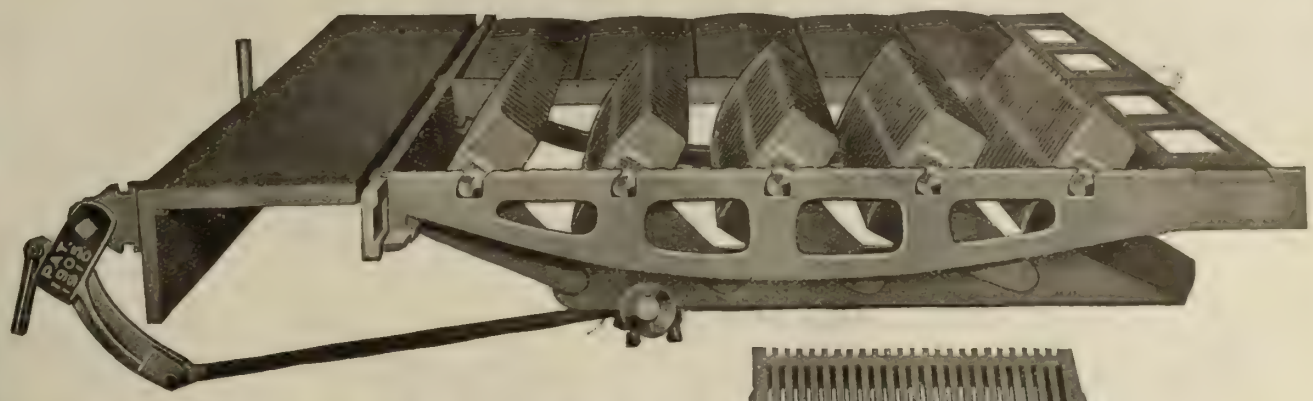
FOR ALL PROBLEMS

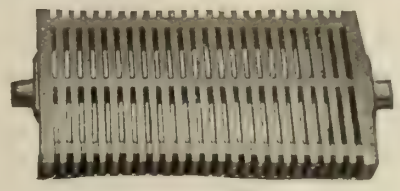
Steam—Grate Bar—Furnace—write THOMAS

The General Supply Co. of Canada, Ltd.

OTTAWA TORONTO WINNIPEG

THOMAS GRATE BAR CO., **Birmingham, Ala., U.S.A.**





REDUCE FUEL BILLS

By Using

"THE Cyclone"

Shaking and Dumping Grate Bar

It has Proved that it Generates more Steam from Less Fuel than any other —Also that it Burns the Cheapest Grades of Fuel with Results Equal to that of the Best.

The Improved Shaking Mechanism assures more rigorous and effective shaking, and prevents any ashes from clinging to the centre of the grate.

The "CYCLONE" is the Grate that locks level—the Grate that cannot get out of adjustment or become warped. Its construction allows 68 per cent. air space and 90 per cent. under draught.

Be sure you get the "CYCLONE" and not an imitation. The fact that it is closely imitated is ample proof of its superiority.

We want to get you in touch with some users—they will gladly relate their experience and you will profit by it.

Write for Illustrated Catalogue.

CANADIAN STEAM BOILER EQUIPMENT COMPANY, Ltd.

SOLE MANUFACTURERS FOR CANADA

211 QUEEN STREET EAST :-: :-: :-: **TORONTO, CANADA**

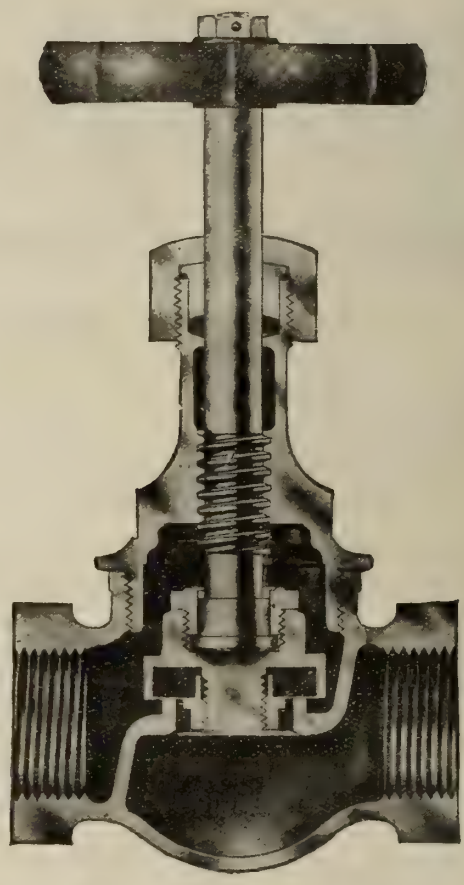
AGENTS

ST. JOHN, N.B., F. W. Blizard, Canada Permanent Chambers. MONTREAL, H. L. Peiler & Co., 308 St. James Street.
HAMILTON, Robt. Fitzsimmons, 8 Grove Street. CALGARY, Alta., The Western Foundry & Metal Co., Limited.
BERLIN, J. Hainsworth, 14 Foundry Street. WINNIPEG, Vulcan Iron Works.

April 28/13
8 Cuts.
Delivered By
Jenkins Bros
W. Walker

TRADE
JENKINS
MARK

Do your valves contain all the features as shown in this Cut ?



NOTE :

The Metal Gland in Stuffing Box.
Heavy Thread on Spindle.
Back-seat on Lock Nut.
Genuine Jenkins Disc.
Raised Seat in Body.
Long Thread on Pipe ends.
Strong Hexagons.

IF YOU FIND THE VALVES YOU ARE USING DO NOT CONTAIN ALL THE ABOVE FEATURES WRITE:—

FULL PARTICULARS AND CATALOG COVERING THE ENTIRE LINE OF JENKINS BROS. VALVES WILL BE FORWARDED UPON REQUEST.

JENKINS BROS.,
LIMITED

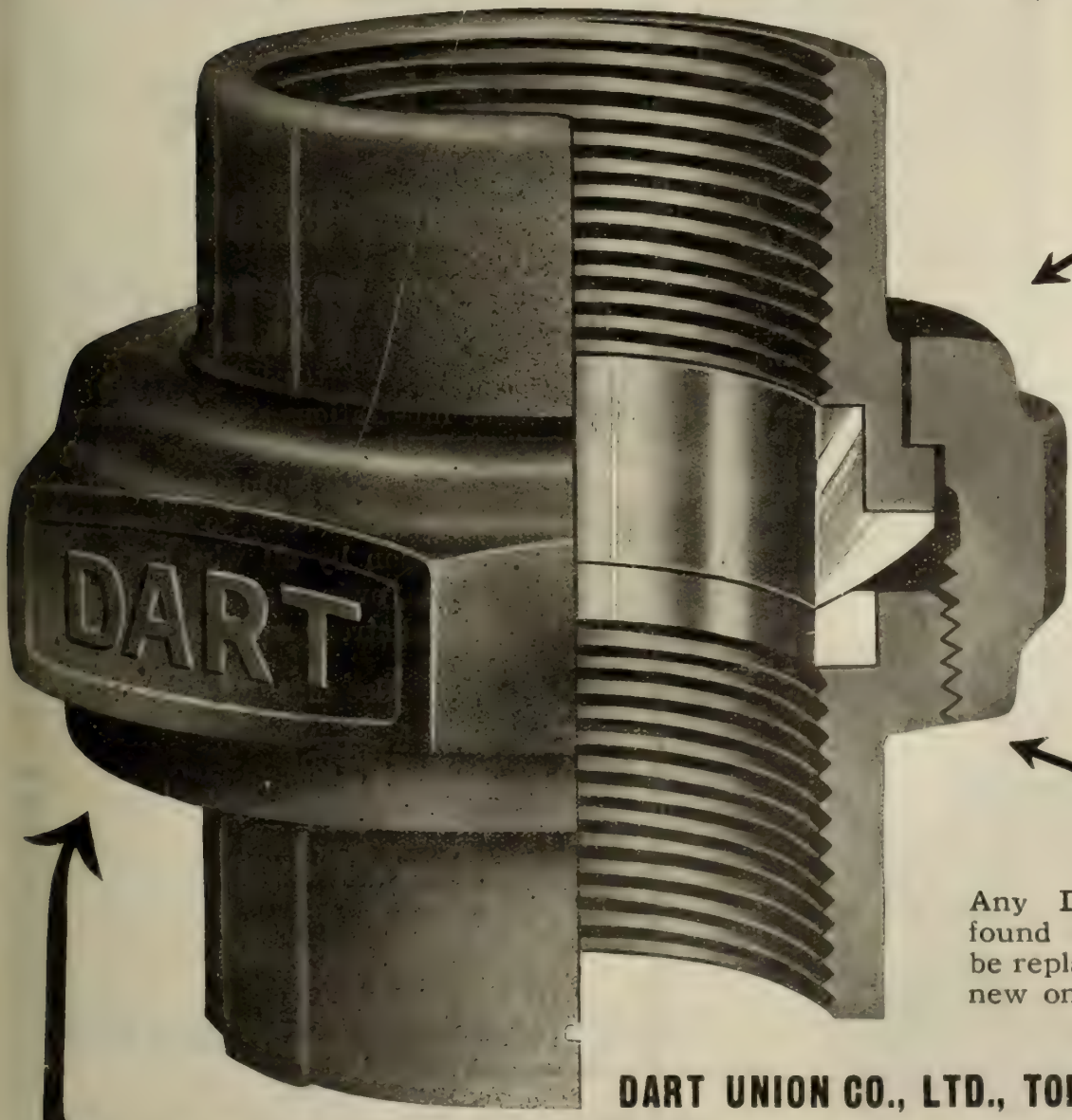
103 St. Remi Street MONTREAL

The advertiser would like to know where you saw his advertisement—tell him.

NEVER LEAKS
NEVER CORRODES
SAVES TIME
REDUCES EXPENSE
EASILY CONNECTED

A Few Reasons Why It Will Pay You To Use

The "DART" Union Pipe Coupling

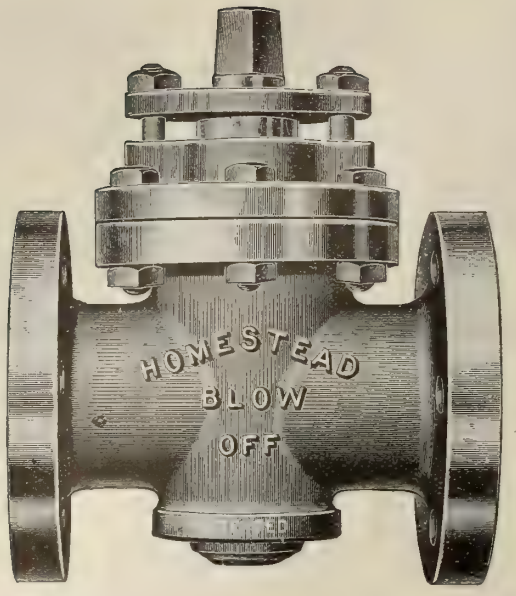


Bronze to Bronze at the Joint

Any Dart Union found defective will be replaced with two new ones.

DART UNION CO., LTD., TORONTO, ONT.

The advertiser would like to know where you saw his advertisement—tell him.



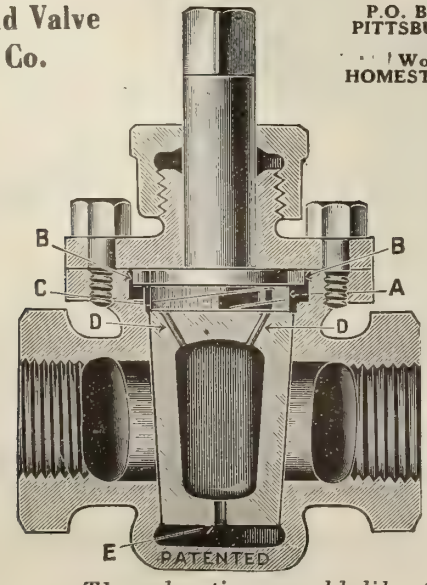
Homestead Valves are Quality Valves

A quarter turn—just a slight twist of the wrist—closes or locks the *Homestead*. A quarter turn back opens it wide. It being free from friction, long life and the maximum of service is assured. This valve cannot jar open—when you lock it, it stays locked. The seats are perfectly protected from wear both when closed and when pressure is passing through them. *Every valve* is hand ground to a perfect fit and tested before shipment. They are absolutely leak-proof under any steam, air or hydraulic pressure. *Homestead Valves* are giving satisfaction throughout the entire world, under the most severe conditions. Just try one if the valves you are now using are weak in some essential point. The many superior points of *Homestead* Straightway, Three-way and Four-way Valves fully described in our catalog. Have a copy?

Homestead Valve Mfg. Co.

P.O. Box 1754
PITTSBURG, PA.

Works:
HOMESTEAD, PA.



6 inch Screwed Iron Body Gate Valve

6 inch Interior View of I. B. B. M. Gate Valve

KERR
IRON BODY
GATE VALVES

The above illustrations are of the new **"KEYSTONE"** pattern gate valve which we are now shipping to our customers, and which is being so favorably commented upon by all who have as yet seen them, owing to their modern equipment and strong compact design.

See that

KERR

is on the body of the next valves you buy.

Specify them, and you'll get them.

The Kerr Engine Co.

LIMITED

WALKERVILLE - - ONTARIO

If You Require Cheap Steam Without Smoke Use

BENNIS Machine Stokers and BENNIS Independent Elevators

Applicable to All Types of Boilers.

"Bennis" U-link Chain Conveyor.

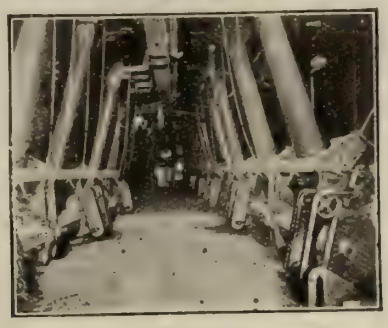


Fig. III.

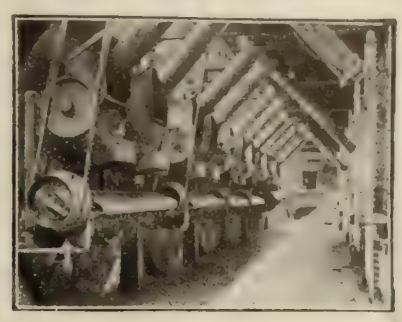


Fig. II.

Write for **Elevators & Conveyors that Pay** pamphlets to:

G. H. TOD

Manning Chambers
Queen Street West
TORONTO

Fig. I.

"Bennis Independent Elevators.

Write for **Machine Stokers that Pay** pamphlets to:—

G. H. TOD

Manning Chambers
Queen Street West
TORONTO

The three leading types of "Bennis" machine-stokers are here shown:—
1. The "Bennis" Sprinkler. This machine is a powerful and rapid steam raiser, and is equal to heavy and variable loads. It burns low-grade fuels smokelessly.
2. The "Bennis" Coking Stoker. This machine keeps an intense fire with low-grade fuels, without smoke or grits, and is specially valuable in paper and pulp mills.
3. The "Bennis" New Link Chain Grate. This machine is fitted for use on water-tube boilers. Its close link of great strength renders it the finest chain grate on the market.

FULTON WATER-COOLED MECHANICAL STOKER

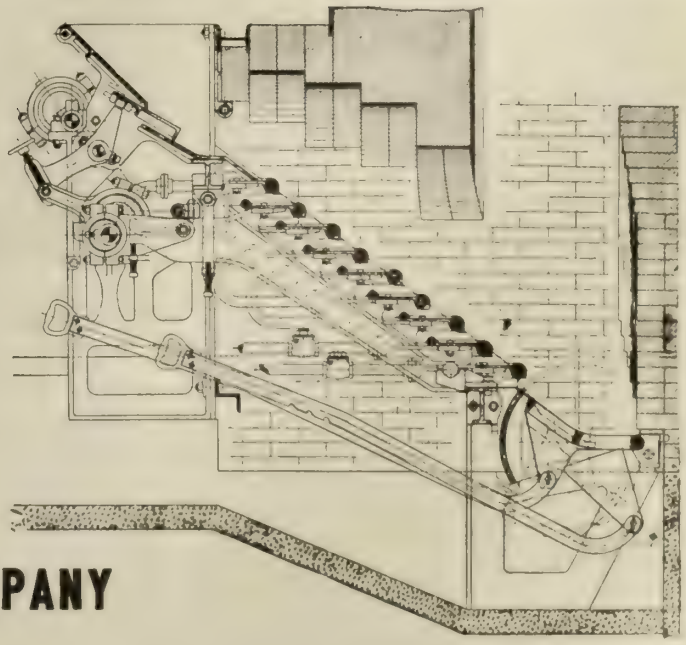
It is Water Cooled.

Repairs Almost Eliminated.

Natural Draft only, but 100% overload easily secured.

Smokeless, in Operation 70-78% Efficiency Obtainable.

Write for Further Particulars.



THE
HARE ENGINEERING COMPANY
Limited

14-16 King Street East TORONTO, ONT.

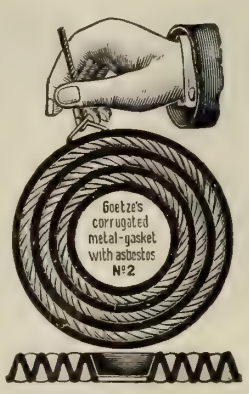
The advertiser would like to know where you saw his advertisement—tell him.

Make Up Your Mind to Make More Money

and avoid a lot of trouble by stopping **promptly, positively** and **permanently** every leak in pipe joints throughout your plant. We'll show you **how to do it and we'll prove that** our method will do it, before we take a cent of your money. We'll prove this right **in your own plant**—under your own eyes—on the worst joints you have—under highest pressure or temperature—in service even with **highly super-heated** or saturated steam, and on **long lines.** We'll do this by sending you

A Supply of Goetze's No. 2 Gaskets On 90 Days' Trial Entirely at *Our* Risk

Then, it will be up to you to give them a try-out that will be conclusive—a trial that will show either that you don't want a Goetze's No. 2 Gasket in your plant, or that you want one of them in **every** flanged pipe joint you own. And **one** in a joint is enough—yes, even where **several** of some other kind have failed to hold. Goetze's Elastic Corrugated Copper Gaskets, with Asbestos Lining No. 2 ("Goetze's No. 2," for short) **cannot** blow out, burn out or give out in **any** way. No other one thing can save you as much trouble, time, coal, money.



If our claims are true, you can't afford to be without Goetze's No. 2 Gaskets. If they are not true, you can disprove them at **our** expense. Send for a supply of Goetze's No. 2 Gaskets to-day, and find out for yourself, once for all, **now.**

Do **You** Have the Usual Leaking Valves in **Your** Plant? Have **you** found it difficult to get a valve gasket that would pack tight and not go to pieces after a few days' or weeks' service? Are you sufficiently tired of such trouble and expense to try a Valve Gasket that comes to you with a **guarantee?**

If we can't prove every word of every claim, we don't want your money.

Are you **willing** to try such a Valve Gasket at **our** risk?

Then Write Us—To-Day—For A Supply Of Goetze's Copper Valve Gaskets on 90 Days' Trial

and **try** them.

Goetze's Copper Valve Gaskets are for valves of Jenkins and similar types. They are made from **chemically pure copper,** with a core of the **best Asbestos.** These materials form a cushion with sufficient elasticity to insure tight closing, yet with the firmness and strength to resist the heat and pressure which so quickly disintegrate and destroy ordinary rubber or "composition" gaskets. The valve seats will close **tightly** on this gasket without injuring it or themselves.

You can put them in without removing valves from piping. **And then you can forget them.**

Made of **Nickel** and Asbestos if you want to use them with acids, etc.

Send for a supply of Goetze's Copper Valve Gaskets and **try them for 90 days at our risk.** Merely give sizes wanted, number of each, and whether with two flat sides inside, or with round hole.

Ask for Catalog of Packings for All Power Plant Purposes.

Goetze Gaskets are carried in stock by

T. McAVITY & SONS, LIMITED

St. John, N. B.

BRANCHES AT

MONTREAL
112 St. Peter Street

WINNIPEG
C. E. Chown, 147 Bannatyne Street

VANCOUVER
c/o A. O. Campbell, 1069 Hamilton Street

MANUFACTURED BY

Goetze-Gasket & Packing Co.

NEW BRUNSWICK, N.J.

How's Your Packing?

Is it working right up to the limit?
If you are using "*Garlock*" it is.
If not, let us equip you.

You Can Depend on Garlock Packing

WRITE US

REGARDING YOUR PACKING REQUIREMENTS

THE GARLOCK PACKING CO.

HAMILTON, CANADA

MONTREAL **TORONTO** **WINNIPEG**

BE SURE YOU GET
"*Genuine Garlock*"

The Trade Mark
WILL TELL YOU

"PIONEERS IN THE PACKING BUSINESS."

Will You Accept Our Slide-Valve Book Absolutely FREE? It is Worth $1.00

This book contains 88 pages, and is fully illustrated with pictures of various types of slide valves, diagrams, etc.;. substantially bound in heavy red cover. The book is worth $1.00—some engineers who have it would not sell it for $5.00. Simply fill out the coupon and mail to us. The book will be sent direct to you, all charges prepaid by us. This offer may not be repeated. Act to-day.

Positively the book will not be sent unless the coupon is completely filled out.

DANIEL'S ROD PACKING P. P. P. COIL RING SPIRAL

How To Get The Valve Book Free

Fill out the Coupon and mail it to us. We will send the book direct to you. You will not be required to go to your dealer for it.

Your Name .....
Address .....
Employed by .....
Address .....
Horsepower of Engine .....
Kind of Rod Packing Used .....
Do you use EBONITE Sheet Packing? .....
Dealer's Name .....
Address .....
Buyer's Name .....Series 24-D.S.

Remember this is a special offer and may not be repeated. Mail your coupon to-day.

P. P. P. is the original and only successful self-setting packing. It adjusts itself to maximum and minimum requirements. The bearing on the rod is just enough to hold steam-tight—never too little; never too much. It reduces friction nearly 90%.

Daniel's P. P. P. Rod Packing is imitated more than any other packing made. But the imitation is in appearance and claims only. None but the genuine gives the results.

Order enough P. P. P. from your dealer to pack a single stuffing box, one time. You will use no other.

QUAKER CITY RUBBER COMPANY

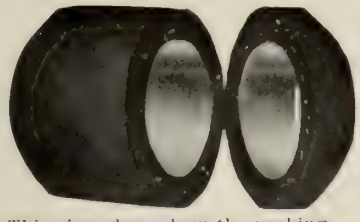
Manufacturers of Mechanical Rubber Goods

PHILADELPHIA, Pa., U.S.A.

SAFETY PLASTIC

Metallic Packing

Is an alloy of the finest anti-friction metals, combined with the best lubricating materials, and formed into shreds which weave together making a self lubricating and frictionless packing of great strength and durability. A perfect packing for steam, water, air, gas, etc. Is guaranteed to stand steam temperature up to 550 deg. Fahr. and hydraulic pressure up to 5000 lb. per square inch. With orders for the packing in bulk form, cotton tubing in assorted sizes is supplied free of charge. Furnished also in thin cotton tubes, sizes 3-16 to 1½-inch and 36 inches long, or in special lengths as wanted.



This ring shows how the packing looks when compressed in a stuffing box.

Saves Trouble— Saves Expense

12 Years In use with Perfect Satisfaction

"Safety" Plastic Metallic Packing is handy to use. Very inexpensive. One third the price of other metallic packing. Lasts ten times as long as fibrous packing. No waste any remnant can be used.

Any Quantity Sent on Approval

We Will Send You a Free Sample

To convince you that "Safety" Plastic Metallic Packing is all that we claim, we will send you a free sample on request.

In cans, 6, 12, 25 and 50 lbs.

WRITE NOW!

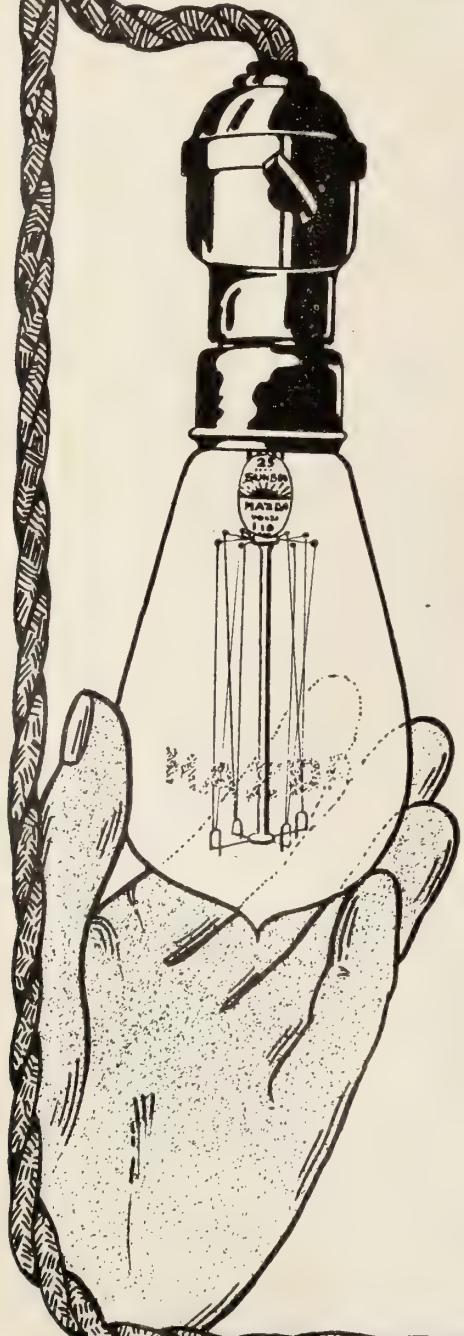
Safety Plastic Metallic Packing is Manufactured Only by the

Steel Mill Packing Company

WINDSOR, ONT., and DETROIT, MICHIGAN.

The advertiser would like to know where you saw his advertisement—tell him.

SUNBEAM MAZDA



Drawn Wire

TUNGSTEN LAMPS

Will Give You Three Times as Much Light as Carbon Lamps at the Same Current Consumption

Our Tungsten Lamps are of the highest prevalent quality.

Replace your old carbon lamps with the "Sunbeam"—it means efficient workmen and accurate production as well as reduced electric light bills.

We ship quickly from stock.

The Canadian Sunbeam Lamp Company, Ltd.

Main Office and Factory:
TORONTO

Branch Warehouses:
MONTREAL WINNIPEG CALGARY VANCOUVER

NEWTYPE BERGMANN LAMPS

(Tungsten Filament)

THE UNBREAKABLE KIND

Are now ready for delivery. We guarantee delivery to you in good condition.

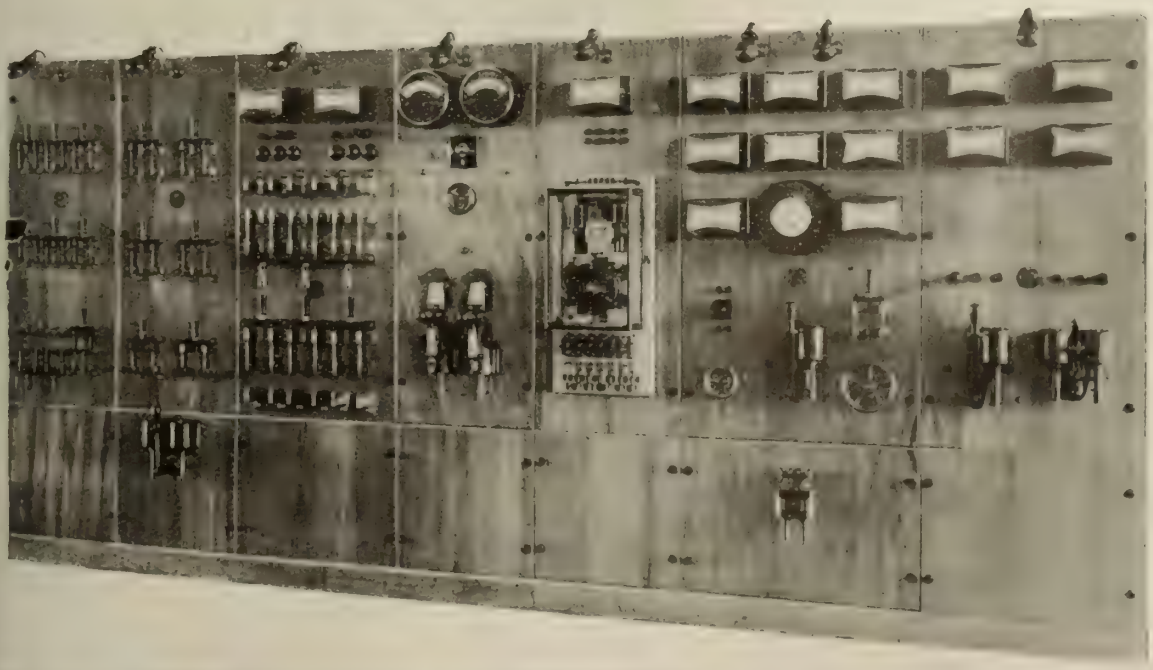
EXCLUSIVE CANADIAN DISTRIBUTOR:

P. H. KLEIN CO., Limited

Live Agents wanted all over Canada. 329 Craig Street West MONTREAL

MONARCH ELECTRIC CO., Limited

ST. LAMBERT, P.Q., District of Montreal



Switch Board Specialists

The advertiser would like to know where you saw his advertisement—tell him.

WESTON

Ammeters and Voltmeters

Absolute Accuracy

—is your first demand when you buy electrical measuring instruments.

You will appreciate, then, the reputation of Weston Instruments.

They are not affected by temperature or service conditions, but are accurate and reliable under the most severe tests.

Full information regarding Weston instruments will be sent to any address. Write our nearest house.

THE Northern Electric AND MANUFACTURING CO. LIMITED

Manufacturers and Distributors of Telephone and Fire Alarm Apparatus and Electrical Supplies for every possible need.

Montreal	Halifax	Toronto	Winnipeg
Regina	Calgary	Edmonton	Vancouver

Do You Want to Buy Something That You do Not Know Where to Get?

EVERY month The Power House receives letters from subscribers stating that they are in the market for certain articles, but that they do not know where they can be procured.

They ask us if we can tell them from what source they can procure the wanted articles. This is a service we render cheerfully.

When you become a subscriber to The Power House this service is part of what you buy.

We have facilities for procuring information about new appliances which have not been extensively advertised, and these facilities are at the service of our readers.

We are glad to get these requests for information and no service could be more cheerfully rendered.

CUT OUT THE COUPON BELOW, and use it when you would like us to give you information.

THE POWER HOUSE

143 University Avenue, Toronto

THE POWER HOUSE
143 University Avenue
TORONTO

For Subscribers

INFORMATION WANTED

Date.....191

Please tell me where I can buy .....

.....

.....

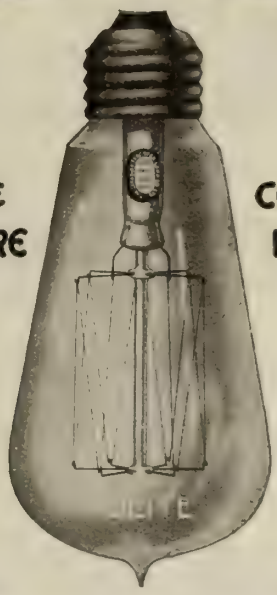
Name .....

Address .....

"NULITE"

TUNGSTEN LAMP

GENUINE DRAWN WIRE



CONTINUOUS FILAMENT

ECONOMY

If your superintendent laid before you a system whereby you could economize and increase the output of your plant, would you adopt it?

CONSIDER

for the time then that we are your electrical superintendent and find that by adopting the tungsten system throughout your plant, allowing each workman one or more lamps, as the case demands, that their productive capacity will increase 10 to 20 per cent. at a total cost to you of approximately two per cent. of the pay roll.

THINK THIS OVER

In your office each clerk and desk has an individual lamp. Why? Think it over, and realize to what extent your workmen would benefit by having individual tungsten lamps over their machines, enabling them to see clearly at all times eliminating the frequent stopping of machinery in order to allow them to take measurements, owing to the defective lighting system in use.

PROOF

The largest industries in the world to-day are using Tungsten lamps, ask any manager of a large factory why they use tungstens, he knows, and will tell you.

"NULITE"

"Nulite" tungsten lamps are the direct result of the need of a durable, long-lived tungsten lamp, so many manufacturers realizing the efficiency of this system have only been waiting for the lamp which will stand up under severe conditions to install it throughout their plants.

WE HAVE IT

Write us for any information pertaining to your lighting problem and our experts will furnish you with the necessary plans of how best to equip your plant.

DON'T HESITATE

It's Our Business.

"NULITE" a Canadian Product

Manufactured by

Branches
Montreal—246 Craig St. W.
Winnipeg—56 Albert St.
Vancouver—365 Water St.

The Canadian Tungsten Lamp Co., Ltd.

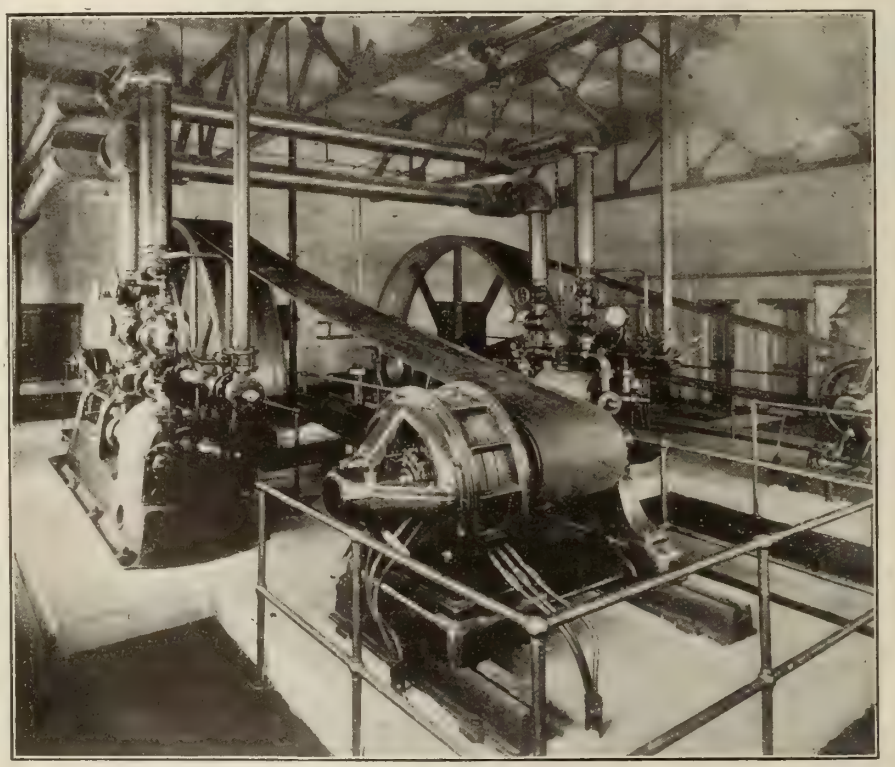
HAMILTON ONTARIO

"THE LINDE"

REFRIGERATING and ICE-MAKING MACHINERY

CORK INSULATION

Over 8,000 Machines in use. Established and Manufacturing in Canada for 16 years.



Two 100-ton "Linde" Belt Drivers, Double Acting, Horizontal Ammonia Compressors Manufactured and Installed by us in Canada.

Recent Orders:—

IMPERIAL BREWING CO., (3 orders), Kamloops, B.C.
WM. CLARK, LTD., Montreal, Que.
MR. J. A. PATRICK, New Westminster, B.C.
C.P.R. VANCOUVER HOTEL, Vancouver, B.C.
MATTHEWS-LAING, LTD., Fort William, Ont.
CARSON'S HYGIENIC DAIRY CO., Winnipeg, Man.
ST. THOMAS PACKING CO., St. Thomas, Ont.
MONTREAL GENERAL HOSPITAL, Montreal, P.Q.
OTTAWA UNIVERSITY, Ottawa, Ont.
WM. DAVIES CO., Winnipeg, Man.
CANADIAN NATIONAL EXHIBITION, Toronto, Ont.
McGILL UNIVERSITY, Montreal, P.Q.
G.T.P. FORT GARRY HOTEL, Winnipeg, Man.
C.P.R. ALGONQUIN HOTEL, St. Andrews, N.B.
AND MANY OTHERS.

The Linde Canadian Refrigeration Co.,

Limited

37 ST. PETER STREET, MONTREAL

Branch Offices—Toronto, Imperial Building, Adelaide St.; Winnipeg, 909½ Main Street; Vancouver, Anderson & Miskin, Imperial Block, Seymour and Pender Streets; Edmonton, Walker & Barnes, 562 Second Street; Calgary, General Supplies Limited, 1233 2nd Street East.

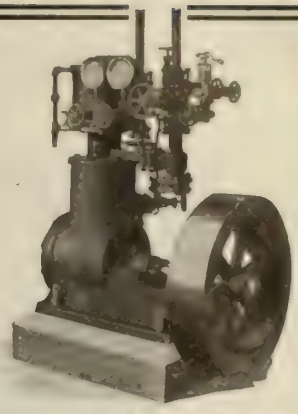
The advertiser would like to know where you saw his advertisement—tell him.

ESTABLISHED 1867.

THE VILTER MANUFACTURING CO.

242 BECHER ST., MILWAUKEE, WIS., U.S.A.

A small machine for small Ice-making and Refrigerating Plants, as well constructed and as successful in operation as larger outfits. VERTICAL SINGLE-ACTING AMMONIA COMPRESSORS, different sizes. Built with fewest possible number of parts. Sold at low price. Excels all others of like size in every point—simplicity, efficiency, reliability, smoothness of action, etc. We build horizontal and vertical ICE-MAKING AND REFRIGERATING MACHINERY, a full line of CORLISS ENGINES, and MACHINERY FOR BREWERS AND BOTTLERS. Our plant covers more than eight acres of ground.



Vertical Single-Acting Ammonia Compressor Enclosed Type for Belt drive.

The LINDE BRITISH

Refrigeration Co. Limited

¶ Numerous fully authenticated laboratory tests organized from time to time in America and Europe, have invariably served to demonstrate in an unanswerable manner, the very remarkable degree of mechanical efficiency to which our products have been brought. ***The history of mechanical refrigeration is our history.***

Head Office: LONDON, ENG.

BIRMINGHAM	GLASGOW	JOHANNESBURG, S.A.
BRISTOL	BOMBAY	SYDNEY, N.S.W.
LIVERPOOL	CALCUTTA	PORT NAPIER, N.Z.

CANADIAN OFFICES
CORISTINE BLDG
MONTREAL

In mechanical strength, wearing quality, fineness of texture and lubricating quality every Le Carbone Brush in a million is absolutely uniform.

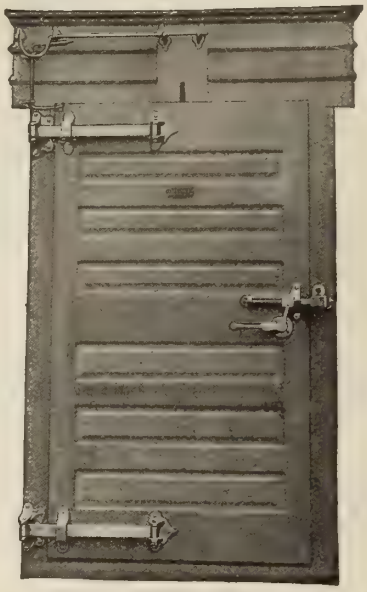
This means that a type of Le Carbone Brush once installed to meet your conditions will always meet them on subsequent shipments. The quality of Le Carbone Brushes never varies.

Rougier Freres, Inc.

63 NOTRE DAME EAST, MONTREAL

The advertiser would like to know where you saw his advertisement—tell him.

J. V. Jamison, President. T. B. South, Vice-President. J. V. Jamison, Jr., Treasurer.



This "Ad" is addressed to users of

Refrigerator Doors, Windows and Ice Chutes

— in Canada —

for Cold Storage, Meat, Fish, Dairy, Poultry, Fruit and Vegetable products.

We guarantee our Doors not to sag or stick in the frames.

Our Hardware weighs 60 lbs. to set.

We manufacture or sell nothing else.

Our entire time and forces are directed to this line.

We supply

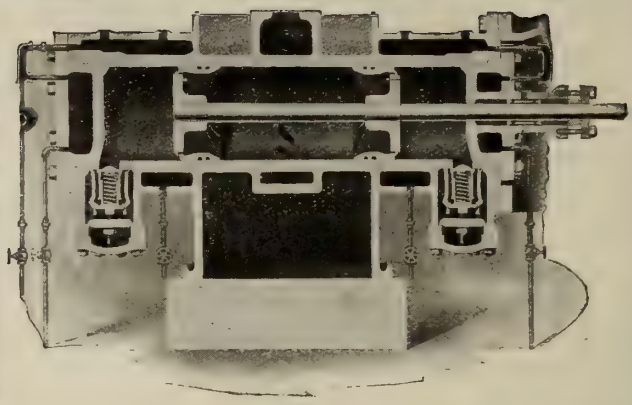
Linde British Refrigeration Co.
Linde Canadian Refrigeration Co. of Canada.
Armour & Co., Chicago, Ill., U.S.
Swift & Co., Chicago, Ill., U.S.

with all they use. Our latest orders are to Swift & Co., for Toronto, Can., 30 Doors; Canadian Fish and Cold Storage Co., Prince Rupert, B.C., 110 Doors.

Send for Catalogue

Jones Cold Store Door Co.

HAGERSTOWN, MARYLAND, U.S.A.



Section Through Arctic Compressor

Raw Water Ice On The Arctic - Pownall System

is the practical, positive method to reduce your ice-making cost.

The Arctic is the only ice machine on earth whose suction valve is absolutely without spring, bolt or nut to work loose. And our raw water freezing system is as simple and dependable as our compressor itself.

Get Arctic bulletins and proposition on your needs—no obligation involved.

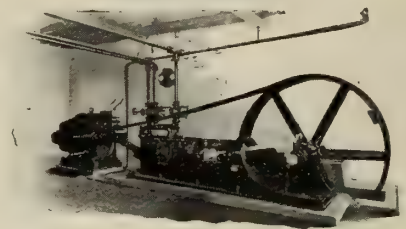
"We Do It Right."

The Arctic Ice Machine Company

Canton, Ohio, U.S.A.

THE SIMPLE SERVICEABLE **SAFETY**

Ice and Refrigerating Machines



THE COMING AMMONIA COMPRESSOR

THE "SAFETY"

Built by

The HUETTEMAN & CRAMER CO.

DETROIT, MICH.

Complete Ice Making and Refrigerating Plants for every conceivable purpose.

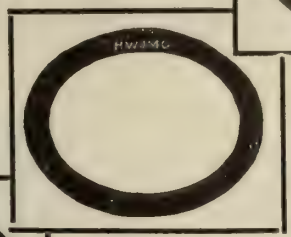
SIX OF THESE "SAFETY" INSTALLATIONS TO DATE IN ONTARIO THIS SEASON

J-M KEARSARGE GASKETS

These gaskets are made in styles to meet all conditions. Due to their resiliency and pliability, they will make permanently tight joints under any condition. Will withstand the highest steam pressures.

J-M Kearsarge Gaskets are made of pure asbestos, so are not affected by heat, boiler compounds, etc. Will outwear several ordinary gaskets.

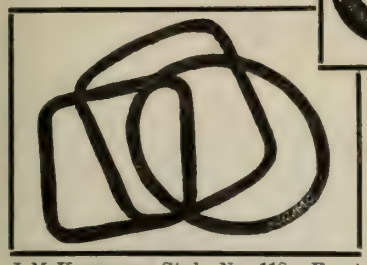
J-M Kearsarge Jointless Style No. 115 For boiler manholes and handholes



J-M Kearsarge Standard Style No. 116 For boiler manholes and handholes

J-M Kearsarge Flange Joint Style No. 126 For Flange Joints

J-M Kearsarge Tubular Style No. 124 For emergency and repair work



J-M Kearsarge Style No. 118. For tube plates of water tube boilers and superheaters.

Being about 25% lighter in weight than other asbestos gaskets, you get more of the Kearsarge per pound.

Write nearest branch for sample and booklet.

THE CANADIAN
H. W. JOHNS-MANVILLE CO., Limited

Manufacturers of Asbestos and Magnesia Products — TRADE ASBESTOS MARK — Asbestos Roofings, Packings, Electrical Supplies, Etc.

TORONTO MONTREAL WINNIPEG VANCOUVER

1377

YORK REFRIGERATING MACHINES

Vertical Single-Acting Machine.

have a reputation for efficiency, durability, and economy.

Our line comprises the Vertical Single-Acting, Horizontal Double-Acting, and Absorption types.

Write for catalog.

York Manufacturing Co.
Main Office and Works: YORK, Pa., U.S.A.

Represented in the Dominion by
CANADIAN ICE MACHINE CO.
163-167 Yonge St. TORONTO

CONDENSER PLANTS

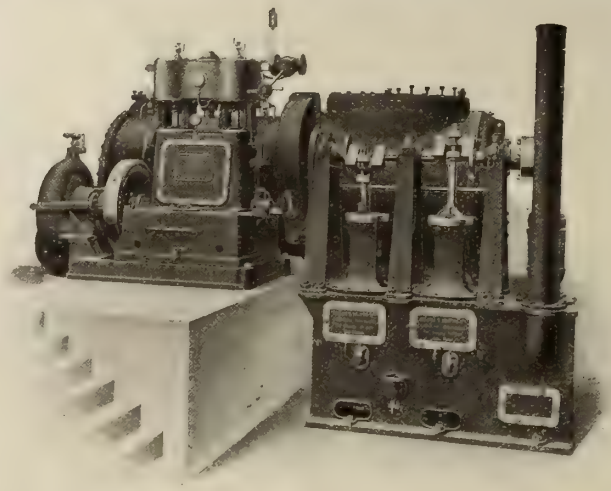
OF THE

"BELLISS & MORCOM" Manufacture

Types
SURFACE
JET

We have installed this type of plant in the municipal plants of:—

Edmonton,
Lethbridge,
North Battleford,
Calgary,
Verdun, and others



Surface Condenser with Air and Centrifugal Pumps, direct connected to a Belliss & Morcom Compound Engine.

Increase the power from your existing **engines.**

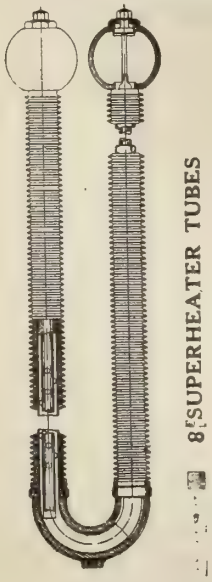
Improve steam **consumption.**

MANUFACTURED BY
BELLISS & MORCOM - BIRMINGHAM, ENG.

AGENTS **LAURIE & LAMB**

211-212 Board of Trade **MONTREAL**

"FOSTER" SUPERHEATERS



If your boilers are not designed for high pressure, or if your boilers have been weakened by use—

Let us fit them up with "Foster" Superheaters in this way, **rendering the boilers serviceable at a moderate cost,** and **without the waste of time and inconvenience** incident to renewal

Write to us for Catalogue on Superheated Steam.

MANUFACTURED BY
POWER SPECIALTY CO., N.Y.

AGENTS
LAURIE & LAMB
211-212 Board of Trade **MONTREAL**

"PATERSON" OIL ELIMINATOR

With

"LEE" WATER RECORDER

fitted when required.

Install one of our Oil Eliminators and **do away with the waste** in heating and engine drip returns **now running to the sewer.**

MANUFACTURED BY
PATERSON ENGINEERING CO.,
LONDON, ENG.

AGENTS
LAURIE & LAMB
211-212 Board of Trade **MONTREAL**

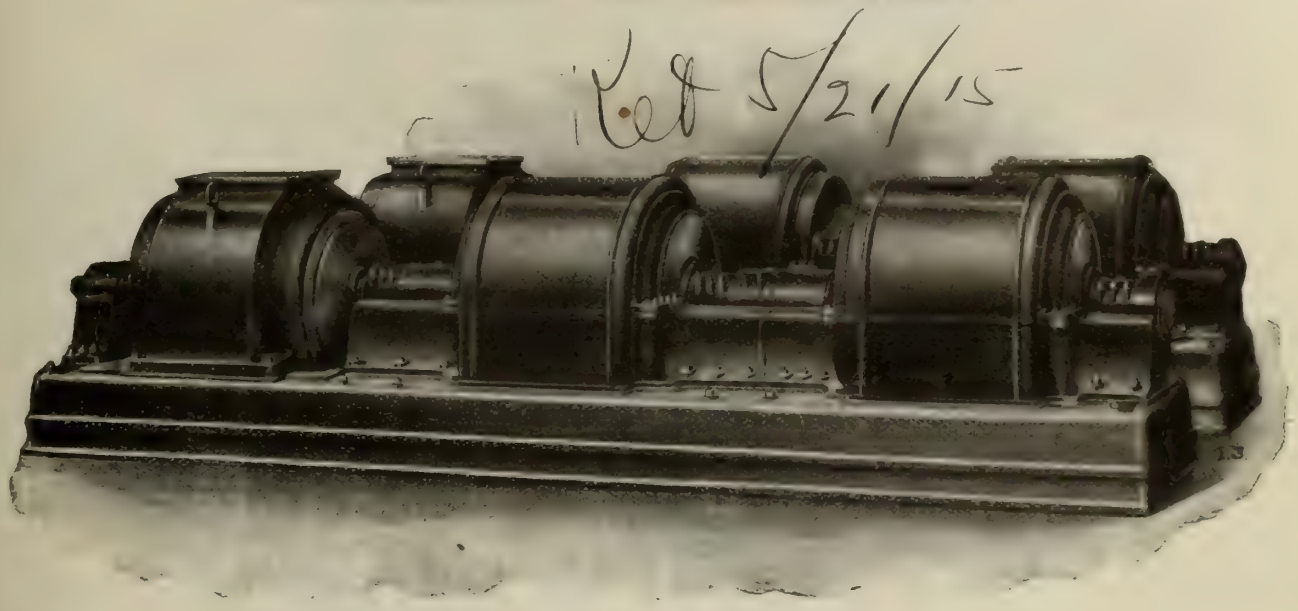
TURBO-COMPRESSORS

DESIGNED AND BUILT FOR

High-Speeds and Large Capacities

In various fields superior to the ordinary reciprocating Air Compressors for

EFFICIENCY and RELIABILITY



TURBO-COMPRESSOR DRIVEN BY ELECTRIC MOTOR

Capacity 21,500 Cubic Feet Free Air per minute delivered against 120 lbs. Gauge Pressure. Built for Victoria Falls and Transvaal Power Company, Ltd., Johannesburg

Recognizing the advantages of and the demand for Turbo-Blowers and Compressors over Reciprocating Air Compressors in various fields, the Worthington Company secured the exclusive rights for the products of Messrs. Pokorny & Wittekind, of Frankfort, A-M, Germany. The differences between centrifugal pumps, in the manufacture of which this company has been most successful, and turbo-blowers and compressors, are principally such as are required to adapt the compressors for handling light and elastic fluids, instead of the heavy and almost incompressible water.

The Turbo-Compressors are built in capacities of 5,000 cu. ft. of free air per min. and over, and speeds of 3,000 to 4,500 r.p.m. They require to be direct driven by either a steam turbine or a 60 cycle motor.

For further particulars and statement of advantages see Bulletin No. 201.

Exclusive Agents for Canada:

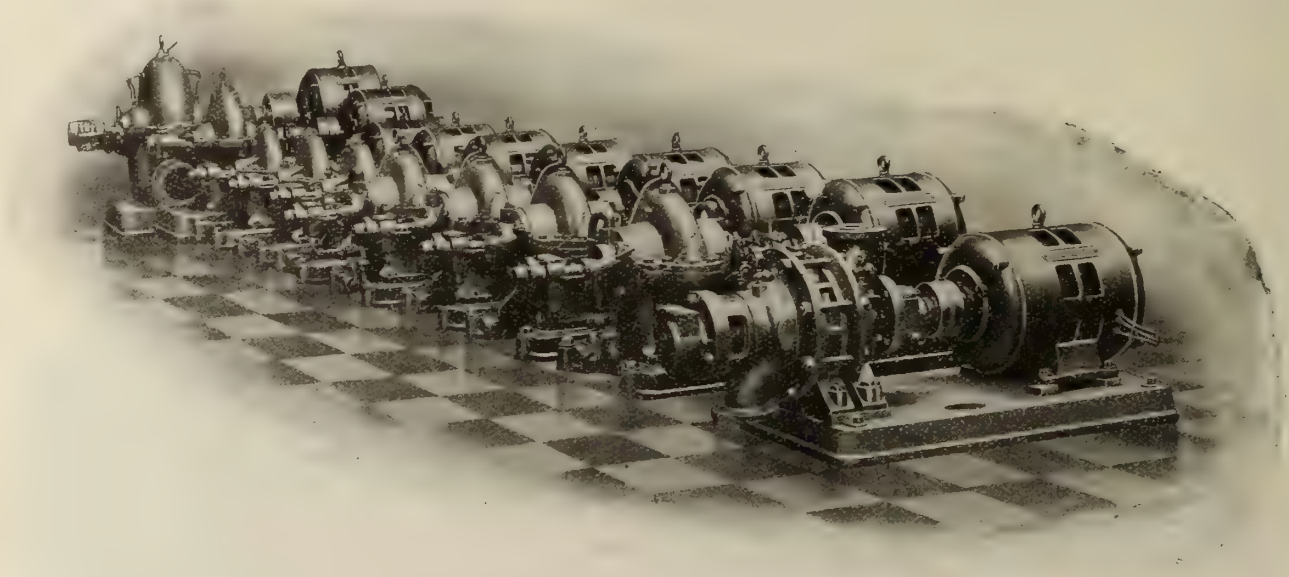
THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., Limited

WORKS - WILLIAM AND SEIGNEURS STS., MONTREAL

W. H. ALLEN, SON & COMPANY

LIMITED

QUEEN'S ENGINEERING WORKS, BEDFORD, England



"CONQUEROR" PUMPING MACHINERY

Suitable for low heads and up to 1,800 feet.
Constant power, constant speed, with
varying head and quantity

Sole Representatives for Canada :

CHAPMAN & WALKER, LIMITED

Engineer for Canada : A. LEO MIEVILLE, A.M. Can. Soc. C.E., A.M.I. Mech. E.

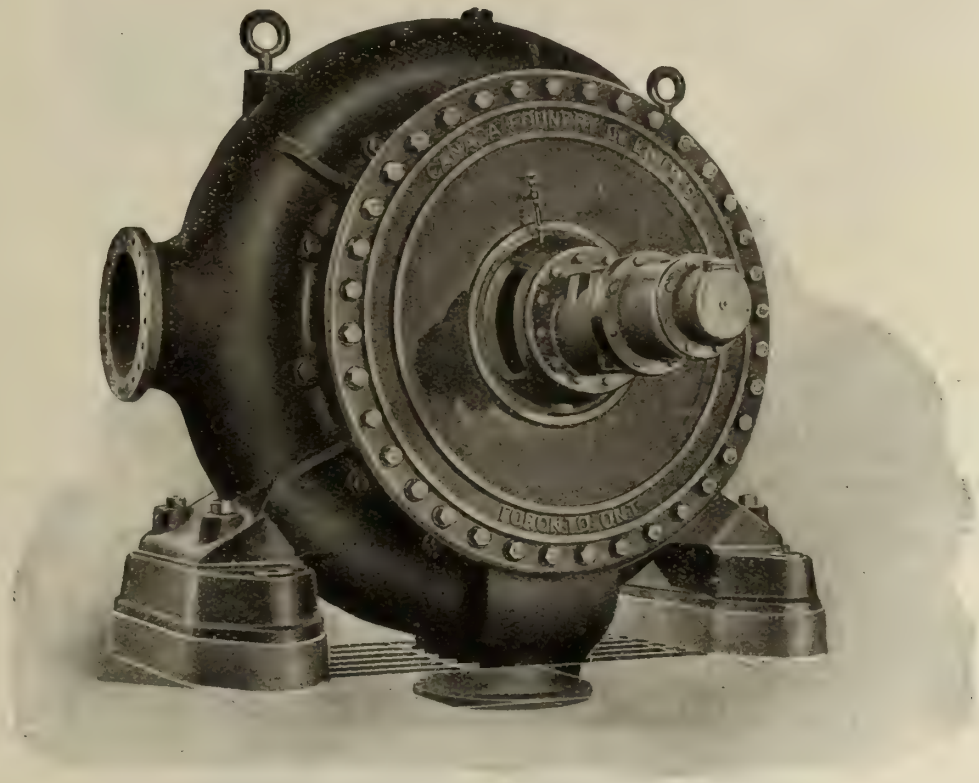
HEAD OFFICE : 69 VICTORIA STREET, TORONTO

The advertiser would like to know where you saw his advertisement—tell him.

Mather & Platt, Limited

PATENT TURBINE PUMPS

For All Duties



24″ Single Stage Turbine Pump

Sole Licencees for the Manufacture in Canada
of the "Original Turbine Pump"

Canada Foundry Company, Limited

Head Office and Works, TORONTO

District Offices:

Montreal Halifax Ottawa Cobalt Porcupine Winnipeg Calgary Nelson
Vancouver Victoria Prince Rupert

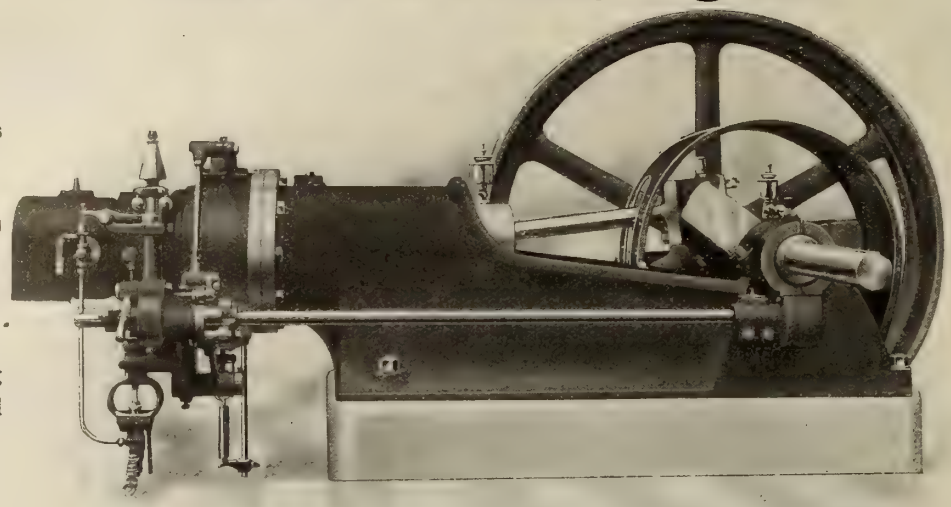
The advertiser would like to know where you saw his advertisement—tell him.

ESTABLISHED 1870.

JOHN ROBSON, (Shipley), Ltd.

SHIPLEY, Yorks, England.

Sole Makers of the "Robson" Oil Engine for working on Crude and Petroleum Oils.

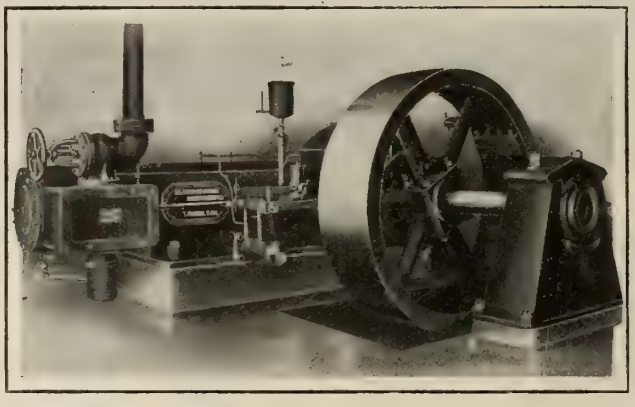


Sole Makers of the "Robson" Engine for working on Towns and Suction Gas.

"Photograph of Oil Engines, (new design) 3½ to 20 B. H. P."

Suction Gas Producer Plants for working on Anthracite Coal, Coke or Charcoal.

AGENTS WANTED. **WRITE FOR CATALOGUE.**



Side Crank Leonard Automatic Engines

Particularly adapted for Direct Dynamo Connection and Electric Light Service. Made in Simple and Compound Units up to 500 Horse Power. For High Economy and Close Regulation this engine is unexcelled.

We also make High and Slow Speed Corliss Engines for Heavy Duty Service. Our "Tangye" Engine is very well and favorably known throughout Canada for Sawmill Work.

MADE BY

E. LEONARD & SONS, LONDON, ONTARIO

MANUFACTURERS OF

High and Slow Speed Engines of all kinds, Boilers, Heaters, Pumps, etc., etc., and complete Steam Plants.

WAREHOUSES AND AGENCIES AT

MONTREAL, ST. JOHN, N. B., CALGARY, WINNIPEG, VANCOUVER

The advertiser would like to know where you saw his advertisement—tell him.

Why Good Lubrication Is Economy

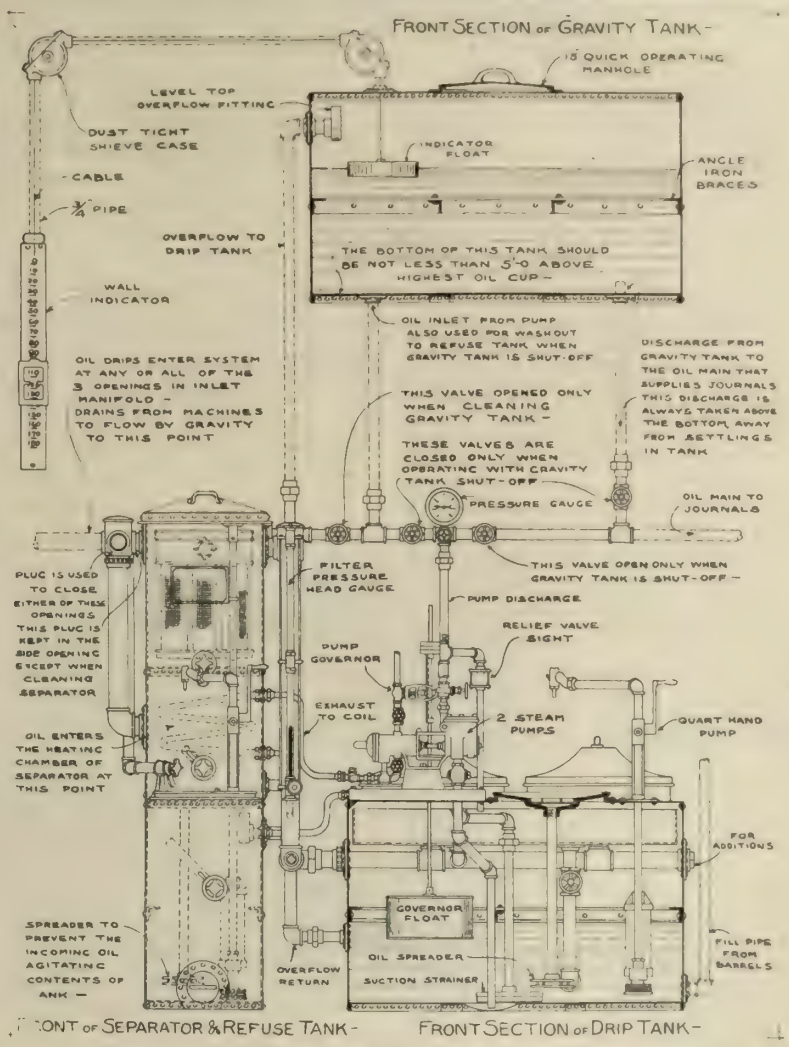
For Small Plants As Well As Large

It is even more profitable for a small plant, because in a large plant cheap labor can be employed for oiling, wiping, etc.

In a small plant it is necessary to keep a high priced engineer most of his time doing a "boy's work." This expert's service could be advantageously utilized elsewhere.

What One Engineer Accomplished

There was installed in a medium sized plant a few months ago a Bowser Oil Filtering and Circulating System that enabled the engineer to devote his saved time to improvements. The result was he constructed two automatic scales that saved the company in the work of building them alone more than double the cost of the Filtering System. This would never have been thought of, much less built, if this same engineer had been confined to the engine room.


FRONT SECTION OF GRAVITY TANK -
18" QUICK OPERATING MANHOLE
LEVEL TOP OVERFLOW FITTING
DUST TIGHT SHIEVE CASE
INDICATOR FLOAT
ANGLE IRON BRACES
CABLE
¾" PIPE
OVERFLOW TO DRIP TANK
THE BOTTOM OF THIS TANK SHOULD BE NOT LESS THAN 5'-0 ABOVE HIGHEST OIL CUP -
WALL INDICATOR
OIL INLET FROM PUMP ALSO USED FOR WASHOUT TO REFUSE TANK WHEN GRAVITY TANK IS SHUT-OFF
DISCHARGE FROM GRAVITY TANK TO THE OIL MAIN THAT SUPPLIES JOURNALS THIS DISCHARGE IS ALWAYS TAKEN ABOVE THE BOTTOM AWAY FROM SETTLINGS IN TANK
OIL DRIPS ENTER SYSTEM AT ANY OR ALL OF THE 3 OPENINGS IN INLET MANIFOLD - DRAINS FROM MACHINES TO FLOW BY GRAVITY TO THIS POINT
THIS VALVE OPENED ONLY WHEN CLEANING GRAVITY TANK -
THESE VALVES ARE CLOSED ONLY WHEN OPERATING WITH GRAVITY TANK SHUT-OFF
PRESSURE GAUGE
OIL MAIN TO JOURNALS
PLUG IS USED TO CLOSE EITHER OF THESE OPENINGS THIS PLUG IS KEPT IN THE SIDE OPENING EXCEPT WHEN CLEANING SEPARATOR
FILTER PRESSURE HEAD GAUGE
THIS VALVE OPEN ONLY WHEN GRAVITY TANK IS SHUT-OFF -
PUMP DISCHARGE
RELIEF VALVE SIGHT
PUMP GOVERNOR
EXHAUST TO COIL
2 STEAM PUMPS
QUART HAND PUMP
OIL ENTERS THE HEATING CHAMBER OF SEPARATOR AT THIS POINT
FOR ADDITIONS
GOVERNOR FLOAT
SPREADER TO PREVENT THE INCOMING OIL AGITATING CONTENTS OF TANK -
OIL SPREADER
FILL PIPE FROM BARRELS
OVERFLOW RETURN
SUCTION STRAINER
FRONT OF SEPARATOR & REFUSE TANK -
FRONT SECTION OF DRIP TANK -

STUDY THIS DRAWING.

Illustration will show you the vantage points of only one type of a Bowser Filtering and Circulating System. We cover the entire field from batch systems for small plants up to the many needs of the largest power plants; horizontal and vertical turbine systems, etc.

Do Away With Useless Labor

If you could install a machine that would do away with one man's labor and yet increase factory efficiency, wouldn't you do it? Would you then let this man, whose labor was replaced by the machine, sit in a chair and do nothing? Wouldn't you find other work for his expert knowledge? These are facts with which you will agree. Then apply them to your engine room—Install a 100% efficiency oiling system—Install a

Bowser Oil Filtering and Circulating System

and secure the services of your engineer elsewhere around your plant. He will welcome the opportunity and you will be the beneficiary. Note the many exclusive features and see "why" and "how" his valuable time can be utilized doing other things than mere "boy's work."

Bowser Filtration Accessories

In addition to the complete system, we carry a complete line of oil fountains, oil cups and attachments, rocker arm joints, sight posts, oil headers, branch supports, blow-off caps, throttle extension, lubricator valves, drip manifolds, fill boxes, etc. These are sold seperate from the system, when so ordered.

Send for free illustrated book. It will give more details.

S. F. Bowser & Company, Inc., 66-68 Frazer Ave., Toronto, Ont., Can.

Made by Canadian Workmen and sold by Canadian Salesmen.

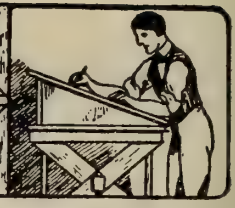
32 Victoria St., S.W., London. Johannesburg. Mexico City. Buenos Aires. Havana. Porto Rico 5 Rue Denis Poisson, Paris

Original Patentees and manufacturers of standard, self-measuring, hand and power driven pumps, large and small tanks, gasolene and oil storage and distributing systems, self-registering pipe line measures, oil filtering and circulating systems, dry cleaner's systems, etc.

Established 1885.

The advertiser would like to know where you saw his advertisement—tell him.

PROFESSIONAL DIRECTORY



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Frederick B. Brown, M.Sc., A. M. Can. Soc. C.E., Mem. A. I. E.E.

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CONSULTING ENGINEERS

Head Office, 232 St. James St., Montreal.
Cable Address, "Walfran, Montreal"—W. U. Code.
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Industrial and Consulting Engineers, Etc.
Power House and Factory Design,
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Mechanical and Hydraulic Engineer
Green Fuel Economizer
Mechanical Draft Apparatus
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Write for Catalogue P.

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Pulp and Paper Mills (Kraft), Water Power Plants, Reinforced Concrete Structures, Steel Structures, Estimates, Reports and Surveys. 512 New Birks Building, Montreal.

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Indicating, valve-setting and general repairs on all kinds of engines.
RENOWN ENGINE & MACHINE CO.
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N. B. GIBBONS
Consulting Engineer.
Mechanical, steam, electrical and hydraulic engineering. Specialist on Automobile and Gasoline engines. Inspection, Appraisal.
NEW BIRKS BLDG. - MONTREAL.
'Phone Up. 6947.

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KENT BROTHERS
Miners and Exporters of
CANADIAN, AMBER MICA
Kingston Ont., - - Canada
Write us for your requirements in MICA

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AND TRADE MARKS
obtained in all Countries.
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Registered Patent Attorney and Mechanical Engineer. Call or write for full information.
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VANCOUVER, B.C.

Eugene F. Phillips Electrical Works, Limited
MONTREAL CANADA

Bare and Insulated Electric Wire
Electric Light Line Wire. Incandescent or Flexible Cords.

Railway Feeder and Trolley Wire
Americanite, Magnite, Office and Annunciator Wire. Cables for Aerial and Underground Use.
HALIFAX TORONTO WINNIPEG VANCOUVER

The advertiser would like to know where you saw his advertisement—tell him.

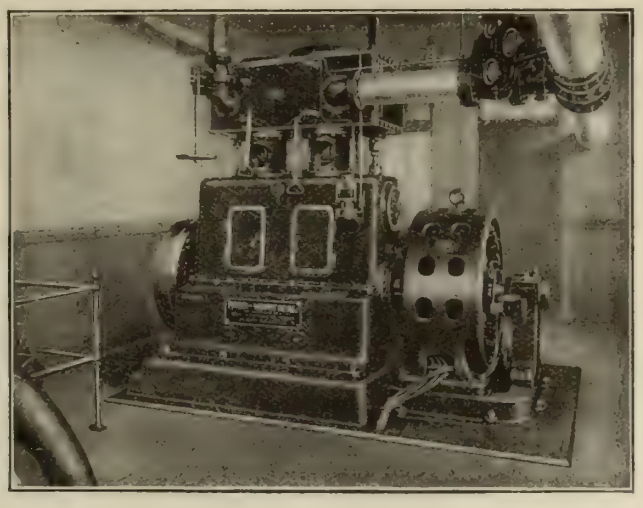
Why is it?

that throughout Canada, in all kinds of power houses, in factories, and in mills, you find

ROBB VERTICAL ENGINES

Because they are built for service, and it's service, not castings, that owners and managers want.

Send for Bulletin 201 Giving Types, Sizes, Dimensions, Etc.



For Direct Connection to Electric Generators of all Types

SERVICE is the result of high speed—direct connection to generators, turbine pumps, fans, etc.

SERVICE, continuous and economical, is assured by completely enclosing all moving parts and lubricating all sliding and revolving parts with oil under pressure.

SERVICE, whether as main engine driving electric generators, or as auxiliaries driving turbine pumps, fans, etc., is what the Robb Engine gives.

Robb Engines are perfectly balanced, accessible, and automatically lubricated.

INTERNATIONAL ENGINEERING WORKS, LIMITED

Manufacturers of

ROBB ENGINES, BOILERS, ETC.

Works: Amherst, N.S., Canada South Framingham, Mass.

SOLE CANADIAN AGENTS FOR
C. A. PARSONS & CO., Newcastle-on-Tyne
Turbines, Turbo-Electric Generators, Turbo Pumps and Compressors

DISTRICT OFFICES:

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Traders Bank Building, Toronto	Wm. McKay, Manager
Union Bank Building, Winnipeg	W. F. Porter, Manager
Grain Exchange Building, Calgary	J. F. Porter, Manager

49-43

HAVE NEVER WORN OUT

A MAGNOLIA BEARING

CLEBURNE ELECTRIC AND GAS CO.,
Cleburne, Texas, March 18th, 1911.

Gentlemen:—

For ten years I have been using Magnolia Metal for a variety of service from small Exciter bearing boxes up to boxes for 14 in. x 18 in. Russell Engines. The results have been uniformly satisfactory, *and I have never worn out a Magnolia Metal bearing box.*

Very truly yours,
C. G. CAMPBELL.

JAMES WATT ASSOCIATION OF STATIONARY ENGINEERS NO. 7
of New York City, N. A. S. E.

New York, November 10th, 1910.

Dear Sirs:—

I have used your metal on heavy duty Corliss Engines at McDermott and Howard's Morocco Tannery, 365 Park Avenue, Brooklyn. In the year 1900 all the main bearings, Crossheads and Crank pins were re-babbitted and *are running up to the present time without the least wear.* Since 1907 I have been in the employ of the City of New York, Engineer Department, Water Supply.

Yours truly, ANDREW J. HOWARD,
203 Willoughby Ave., Brooklyn.

SOLD BY LEADING DEALERS EVERYWHERE OR BY

MAGNOLIA METAL CO.

225 St. Ambroise St., Montreal

NEW YORK **CHICAGO**

SPECIAL OFFER

PRACTICAL ENGINEER POCKET BOOK—700 pages; over 2000 subjects. Price 40c post paid. We import these books in large numbers from England, as an advertising medium, and give Engineers benefit of low price. They are highly spoken of. Address Montreal Office.

A FEW FACTS ABOUT "SPRINGBAK"

WHAT WE CLAIM:

¶ We claim "**SPRINGBAK**" packing is the first and only common sense, practical and fool-proof packing ever invented. It is an ideal packing for almost every condition of service existing in the modern power plant. An emergency packing in most convenient form.

¶ We claim "**SPRINGBAK**" Packing will last months where other packings last weeks.

OUR GUARANTEE:

¶ We guarantee that "**SPRINGBAK**" Packing will do all we claim for it. If it does not, we will pay for every pound you purchase. We also absolutely guarantee it to be superior to any other packing. By far the most economical and constructed from better quality materials than ever have been used heretofore by any manufacturer of packing.

¶ We guarantee it to give triple service as compared to any other make of rubber and duck packing.

NOTE ITS CHARACTERISTICS:

¶ It is pliable, tough, elastic and durable.

¶ It responds quickly to conditions calling for compression or expansion.

¶ It adapts itself to non-alignment.

¶ The elastic core constitutes an air chamber or oil duct.

¶ Any of its four sides is a wearing surface—immaterial how the packing is applied.

¶ The rubber or elastic core is oil and ammonia proof.

¶ When the pressure is lessened, the packing returns to its original form.

¶ A slight gland pressure will prevent leaking without excessive wear and the friction is reduced to a minimum.

¶ Leakage cannot occur because of a decrease in temperature and contraction.

¶ Each coil is moulded separately and does not follow at all the old line construction of ordinary spiral packings, and is **much lighter in weight.**

CAUTION:

¶ Do not use "**SPRINGBAK**" Packing **alone** against a steam pressure that exceeds 125 lbs. or on a high speed engine. We guarantee equal results, however, when same is used in combination with our Ankorite High Pressure Packing. Apply each style alternately

NOTE THIS:

¶ For STEAM HAMMERS—for OUTSIDE PACKED PLUNGERS—for ELEVATOR PLUNGERS—for AMMONIA—for HOT OR COLD WATER—"**SPRINGBAK**" Packing is unexcelled.

STYLE NUMBERS:

No. 123 Ring Form—No. 223 Spiral Form—No. 323 Coil Form.
In all sizes, ¼ in. and larger.

THE ANCHOR PACKING CO.
of Canada, Limited

WALKERVILLE	MONTREAL	TORONTO	WINNIPEG
	404 St. James St.	205 Yonge St.	63 Scott Blk.

ALSO SOLD BY:

WESTERN SUPPLY & EQUIPMENT COMPANY, Ltd.

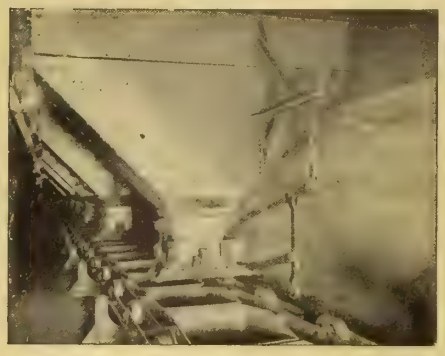
EDMONTON CALGARY LETHBRIDGE

Direct Importers of Genuine "**TAURIL**" Sheet Packing.

Jeffrey

Close-Lip Pivoted Bucket Elevator-Conveyer

Adapted where coal and ashes are loaded automatically.



The Automatic Loaders used with this type of conveyer, as illustrated, not only insure a uniform filling of the buckets, but practically eliminate spillage.

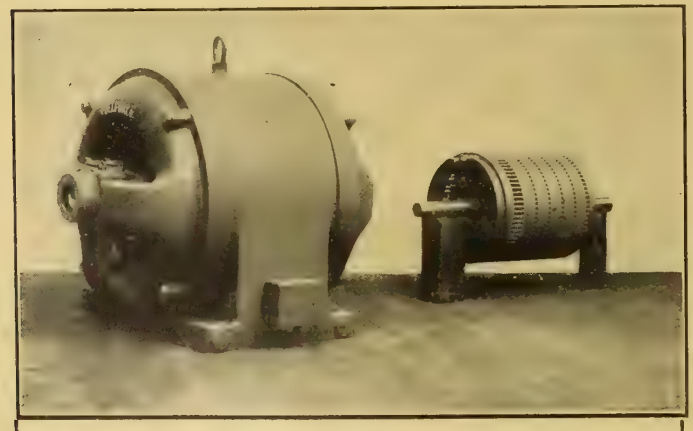
We also build these equipments in several sizes for handling sand, stone, ores, hot clinker, etc., with capacities ranging from 25 to 100 tons per hour.

Catalog 32—A, illustrating and describing numerous installations, yours for the asking.

JEFFREY MFG. COMPANY

Canadian Main Office and Works, MONTREAL

Winnipeg Representatives, N. J. DINNEN & CO.



HIGHSPEED INDUCTION MOTOR

POWER PLANTS, ROLLING MILLS, MINING, HOISTING MACHINERY

ELEVATORS PATENT "STIGLER"

Builders under patents of "STE. ALSACIENNE'

Belfort (France) Mulhouse, Grafenstaden (Germany)

Engineering Works of Canada

MONTREAL, Quebec

Do You Want to Buy Something That You do Not Know Where to Get?

EVERY month The Power House receives letters from subscribers stating that they are in the market for certain articles, but that they do not know where they can be procured.

They ask us if we can tell them from what source they can procure the wanted articles. This is a service we render cheerfully.

When you become a subscriber to The Power House this service is part of what you buy.

We have facilities for procuring information about new appliances which have not been extensively advertised, and these facilities are at the service of our readers.

We are glad to get these requests for information and no service could be more cheerfully rendered.

CUT OUT THE COUPON BELOW, and use it when you would like us to give you information.

THE POWER HOUSE

143 University Avenue, Toronto

THE POWER HOUSE
143 University Avenue
TORONTO

For Subscribers

INFORMATION WANTED

Date.....191

Please tell me where I can buy .....

.....

.....

Name .....

Address .....

SAVE 50%

By Using
GREASE AS A LUBRICANT
In The

"PHILADELPHIA" GREASE CUP

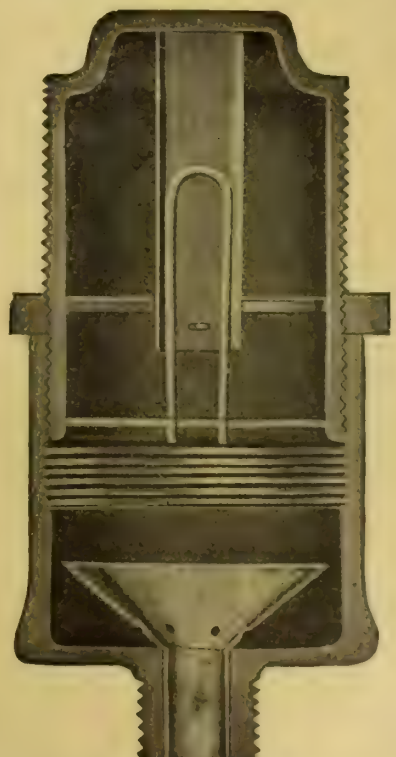
Automatic Feed Under Compressed Air
Slow And Continuous
No Oil Drips—Reduced Fire Hazard

Unexcelled for Lubricating Loose Pulleys, Crank Pins and all classes of Extremely High Speed and Heavy Running Machinery.

In the "Philadelphia" Grease Cup System of lubricating there is no friction, no piston or spring is used, just a thin metal disc resting lightly on the grease to keep it level.

Air pressure above and the needs of the journal below are all that is required to give perfect lubrication. Grease does not change in the slightest, while in the "Philadelphia" Cup; the last drop is as good as the first.

There is a large unrestricted outlet and a regularity of action which permits feeding of grease of any thickness.



We guarantee a saving of at least 50% over any other system. You must be perfectly satisfied before you pay a cent.

Our Booklet tells more about it — write to-day.

Peterborough Machine & Lubricator Co., Limited

PETERBOROUGH, ONTARIO

HOW ABOUT YOUR TRANSMISSION MACHINERY ?

When you think of it, think of

Hill Friction Pulleys and Cut Off Couplings

HERE ARE SOME OF THE SPECIAL FEATURES

POSITIVE ACTION (No springs.) Great mechanical stability, conservatively rated—LARGE POWER ACCESSIBILITY.
HILL COLLAR OILING BEARINGS combine ECONOMY and low CUT MAINTENANCE and are furnished in ALL FORMS OF MOUNTING.
TURNED STEEL SHAFTING, GEARING, PULLEYS, BELT TIGHTENERS, FLY WHEELS.
"YANKEE" patent removable split rim Sprockets.
"WOOSTER" solid woven BELTING.
ELMIRA Wood Split PULLEYS.

To-day is the day to communicate with us.

THE A. M. ELLICOTT CO.

301 St. James Street **MONTREAL, QUE.**

"Maple Leaf" Brand

Stitched Cotton Duck Belting

THE BEST FOR ALL KINDS OF BELTS

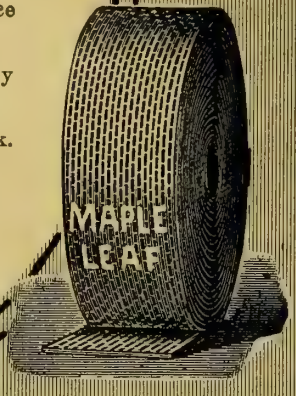
Means Reduced Upkeep Expense and Efficient Service

There is a "Maple Leaf" Belt for every service from the heaviest drive to the smallest light belt.

It is durable under dry or wet conditions, and is by far the most economical belting that you can use.

It is made by experts from plies of selected duck. Absolutely guaranteed.

Ask us for further information and prices.



Dominion Belting Co., Ltd.,

HAMILTON, CANADA

Use Stephenson Bar Belt Dressing

Make 1913 a record breaking year. Turn over a new leaf and get rid of the things that have been causing needless trouble and expense. Adopt the things which will make your work easier, give better results and save money for your employer. You cannot start at a better place than with your belt dressing.

Get rid of your troublesome liquid dressing. Shake the can for the Stephenson solid stick and shake trouble at the same time.

Stephenson Bar Belt Dressing is a friend in need. It doesn't require preparation, nor do you have to use special care in applying it. The minute the belt slips you hold the Stephenson bar to the belt for a few seconds and the slipping stops. There's no waste—no slop—no smearing on of paste or pouring on of spattering liquid. And the results are better.

I'll "Stick to the Solid Stick"

Start With a Free ½ Lb. Sample

Simply send us your name and address and we'll send you a present in the shape of a free half-pound sample of Stephenson Bar Belt Dressing.

Remember—we give you this sample absolutely free of charge. Get this free half-pound of the finest belt dressing made and test it. Here's your chance to try somesomething really good at no expense.

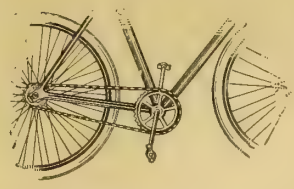
None Genuine Without Trade-Mark

Stephenson Manufacturing Company

Est. 1888 — Albany, N.Y. — Inc. 1897

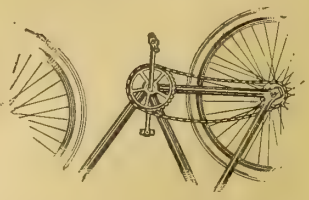
The advertiser would like to know where you saw his advertisement—tell him.

Wrong Way

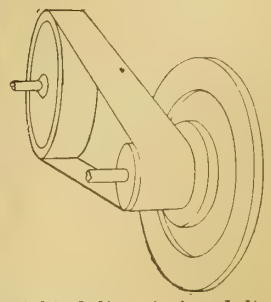


Tight chain; runs hard, pops, climbs sprocket teeth and breaks balls in the bearings.

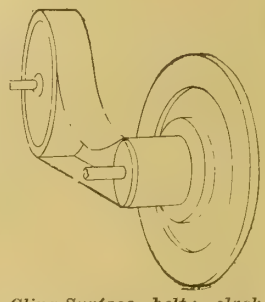
Right Way



Loose chain; runs easy, noiseless, meshes perfectly and absorbs little power.



Tight belt; strains belt, pulley, bearings, hanger and shafting. A prolific cause of hot boxes and burned belt surface.



Cling-Surface belt; slack, but no slip, soft, velvety surface, all internal belt strains eased, bearings run cooler, power saved and belt preserved.

Cling-Surface virtually puts teeth on a polished pulley.

Automobilists, bicyclists and other users of chain drive run the chains slack because CHAINS CAN RUN SLACK. Tightness here is objectionable because it creates unnecessary strain and wear within the chain and wastes too much power.

Tightness of belts is just as harmful to the belt and as wasteful of power, and just as unnecessary. Users of Cling-Surface run their belts slack or easy because belts so treated NEEDN'T BE RUN TIGHT. The "teeth" put on the pulley are really "in" the belt. No matter how smooth and highly polished or how rough the pulley, a Cling-Surface-treated belt will give it the no-slip grip. Slack Cling-Surface-treated belts pull without slipping, simply because they are pliable and thoroughly WRAP the pulley. Isn't that reason enough?

Cling-Surface is essentially a whole-belt treatment, not a surface treatment. Besides stopping slip it waterproofs, prevents chafing, cracking, hardening, burning, and lengthens the life of the belt materially. It positively reduces the power loss in any plant or shop running belts tight, and prevents slip better than will tension.

Few engineers nowadays maintain the belief that tightness is essential for prevention of slip. It is universally admitted that slack is desirable, and only a question whether slack belts are possible. The illustrations of slack belts that we show constantly are NOT special cases, nor freaks, but plain every day examples of what Cling-Surface is doing from one end of the country to the other. We are always ready to prove to those who are doubtful. You will find no statement of ours untrue. Take advantage of our trial offer and convince yourself. Give your belts the serious attention that belts deserve and you will ultimately have to come to Cling-Surface.

Write for further proof and ask for quotations. We quote f.o.b. Toronto.

Cling-Surface Co

1057 Niagara Street Buffalo N Y

54

THE

CANADIAN CASUALTY AND BOILER INSURANCE COMPANY

ATTENTION:

In what condition have you left your heating boiler? we would like the privilege to inspect it, and report to you what has to be done before the next heating season.

CONTINENTAL LIFE BUILDING

TORONTO

J. O. B. Latour, Chief Engineer.

John J. Durance, Manager.

Phone Main 6941

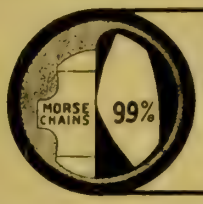
Not an Enterprise for the "Quitter"

"If there is one enterprise on earth," says John Wanamaker, "that a 'quitter' should leave severely alone, it is advertising. To make a success of advertising one must be prepared to stick like a barnacle on a boat's bottom.

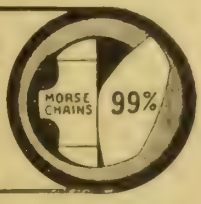
"He must know before he begins it that he must spend money—lots of it.

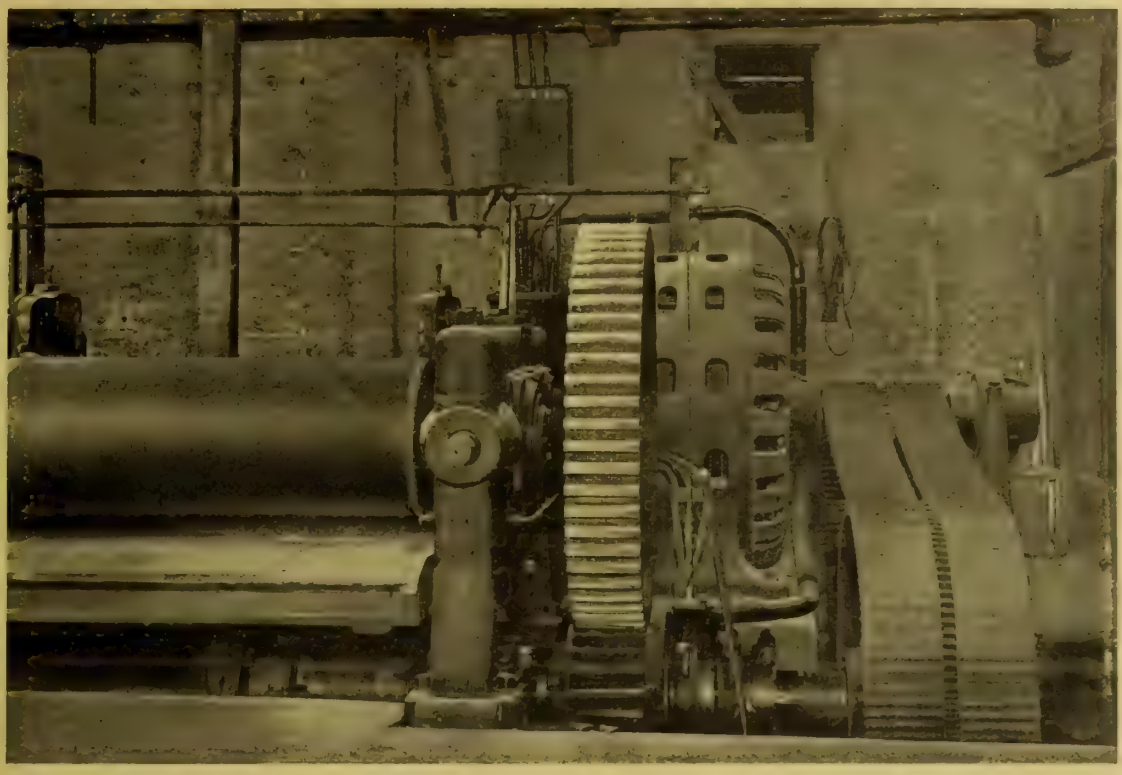
"Somebody must tell him that he cannot hope to reap results commensurate with his expenditure early in the game.

"Advertising does not jerk; it pulls. It begins very gently at first, but the pull is steady. It increases day by day and year by year, until it exerts an irresistible power."



Morse Rocker Joint Silent Chains Prevent Power Losses And Save You Money.





Double Chain Drive, 10 inches wide, 1½ in. pitch, transmitting 200 horse-power at a speed of 1250 F.P.M.

First the System, then the Type

After you have decided to use silent chain transmission, you must decide on the *type* of chain. You can't afford to install the wrong type. The right type in this case is the best type.

"Morse" Silent Chains

in every size, from ¼ to 3,000 horsepower, have proved our claims of superiority.

Where it is excessively hot or severely cold; very dry and dusty or damp; for light service or heavy service, continuously or intermittently, they do their work silently, efficiently and satisfactorily with no other attention than an occasional lubrication.

The exclusive "rocker-joint" construction is the reason.

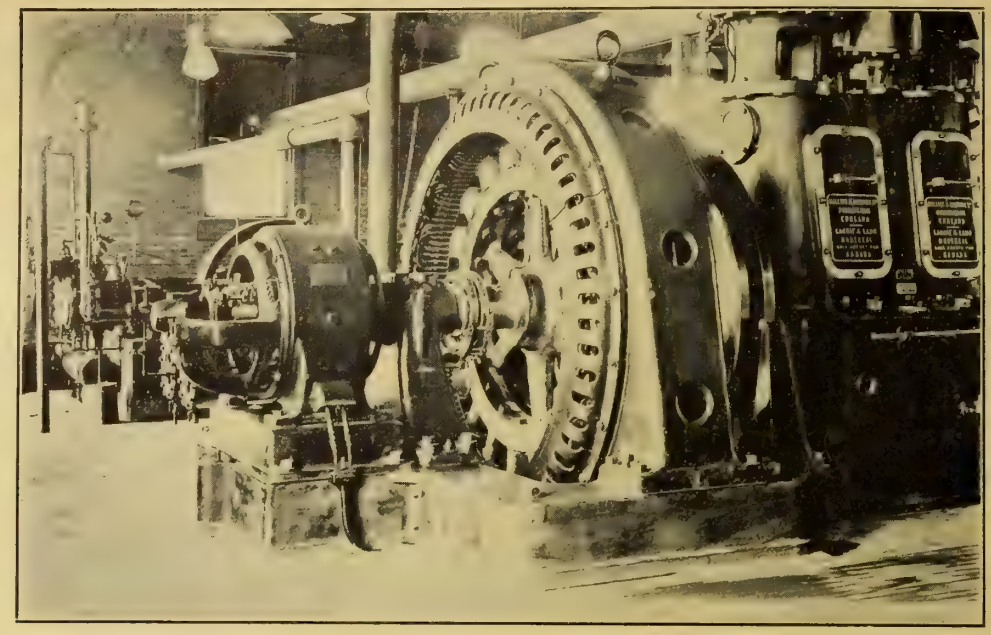
If you have been using transmission other than Morse Silent Chains with unsatisfactory results, will you risk a two-cent stamp against the knowledege of a better drive?

Write us to-day and ask for a copy of Bulletin C-11 and any other information you may desire.

"Ask us to show you how | **Morse Chain Company Ithaca, N.Y.** | the rocker joint does it"

The advertiser would like to know where you saw his advertisement—tell him.

High Class Swedish Electrical Equipment



Owing to liberal design and the use of the best grade of Swedish Steel and Iron, we are able to guarantee and obtain the very best results.

350 K.V.A. 2200 Volt, 2 Phase, 60 Cycle, 360 R.P.M., AC. Generator connected to Bellis & Morcom High Speed Engine, supplied to Corporation of Wetaskiwin, Alta.

KILMER, PULLEN & BURNHAM, Limited

Head Office : TORONTO **Branch Office : MONTREAL**

ADANAC RED CORE RUBBER COVERED WIRES AND CABLES

Are made according to the specifications of the National Board of Fire Underwriters. The conductors are drawn from copper of the highest conductivity and are covered with two thicknesses of thoroughly vulcanized rubber compound of high quality. The wires are braided over insulation and the smooth high finish they receive makes them specially desirable for conduit work.

IMPERIAL WIRE AND CABLE COMPANY
Limited
MONTREAL

THE Northern Electric AND MANUFACTURING CO. LIMITED
Sales Agents

TORONTO REGINA WINNIPEG
CALGARY EDMONTON VANCOUVER

Cast Iron Split Pressed Steel Pulleys

6 to 11 in. diameter, 8 to 12 in. face inclusive.

May 16th/13.
1 Cut Delivered By-to-Walter.

We are Canadian Agents for

The PHILIPS Pressed Steel PULLEY

The Pulley that Insures a Long Efficient and Economical Service

The **Philips** Pulley is a combination of great strength and grace. It runs absolutely true and can be quickly placed on shaft without disturbing same.

The face presents an even, unbroken, perfect crown, furnishing entire belt contact, and permits no power to be lost between belt and pulley.

Philip's cast steel pulleys weigh one-half as much as similar sizes in cast iron, and consequently decrease the friction load and weight on the shafting to that extent.

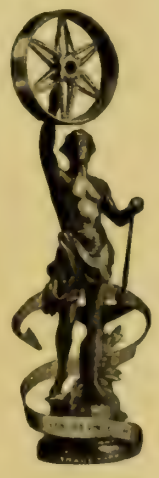
Philip's Cast Iron Bushings are lathe turned and bored, insuring perfect fit, and their use permits the placing of a pulley on different diameter shafts by simply an exchange of bushings.

Philip's Pulleys are guaranteed equal under all conditions to double belt cast iron pulleys.

Let us furnish you with complete details.

Steel Split Pulley from 12 to 48-inch Diameter; 3 to 12-in. face.

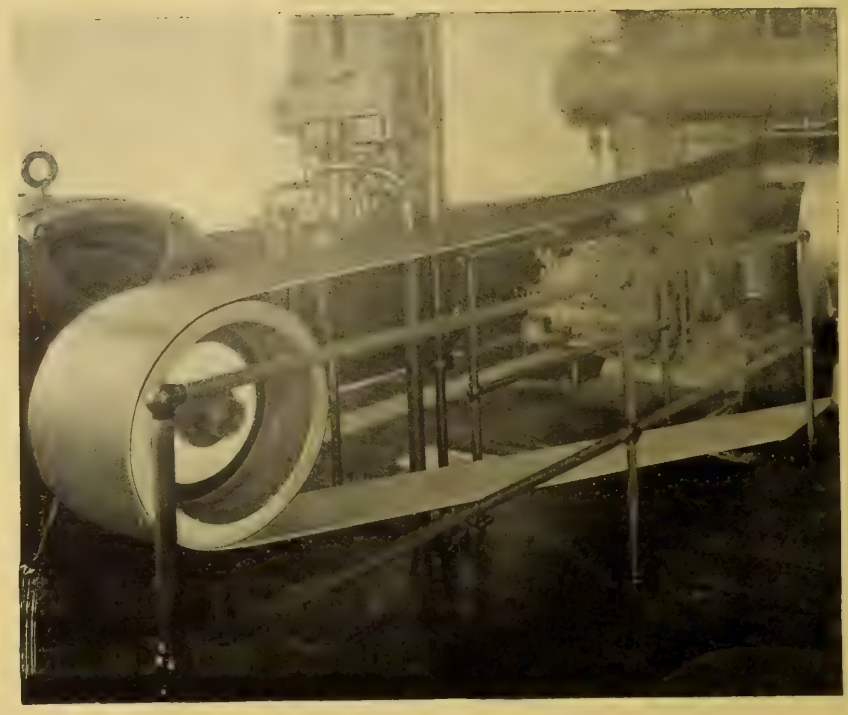
We carry a full stock of all sizes.



D. K. McLAREN, Limited

St. John, N.B., 64 Prince William St. | Montreal, 351 St. James St. | Toronto, 200 King St. West. | Vancouver, 37 Alexander St

This Advertisement should interest Every Man who uses BELTING



On all your belt drives, whether straight or crossed, it will pay you to use

Scandinavia Belting

Scandinavia Belt has a good surface for gripping the pulley. It's tensile strength is enormous. It runs true. It can be used for either a wet or dry place. (We do not, however, recommend it for places where the conditions are alternately wet and dry).

It runs exceptionally straight on the pulleys.

Scandinavia Belting will save money in both the first cost and the maintenance.

For drives where the conditions of moisture are constantly changing from wet to dry, we recommend our Lanco Balata belting, to which we call your attention in the next column.

LANCO BALATA BELTING

can be used under almost any conditions except those of heat.

This belt is made of thirty-eight ounce duck, woven as tightly as it is possible to weave it, and is then well filled with a Balata solution, and heavily calendered.

It is stretched in the process of making, and after being filled with the Balata solution, does not "go back."

Lanco Balata belt is as nearly stretchless as it is possible to make good belt, the maximum stretch being about three-quarters of an inch in ten feet.

Our Balata Belts can be made Endless on short notice.

We carry a large Stock of both Lanco Balata and Scandinavia in Toronto and Montreal

We have issued some very handsome bulletins on both the above belts, and would be very pleased to send either or both to you on application.

Federal Engineering Company, Limited

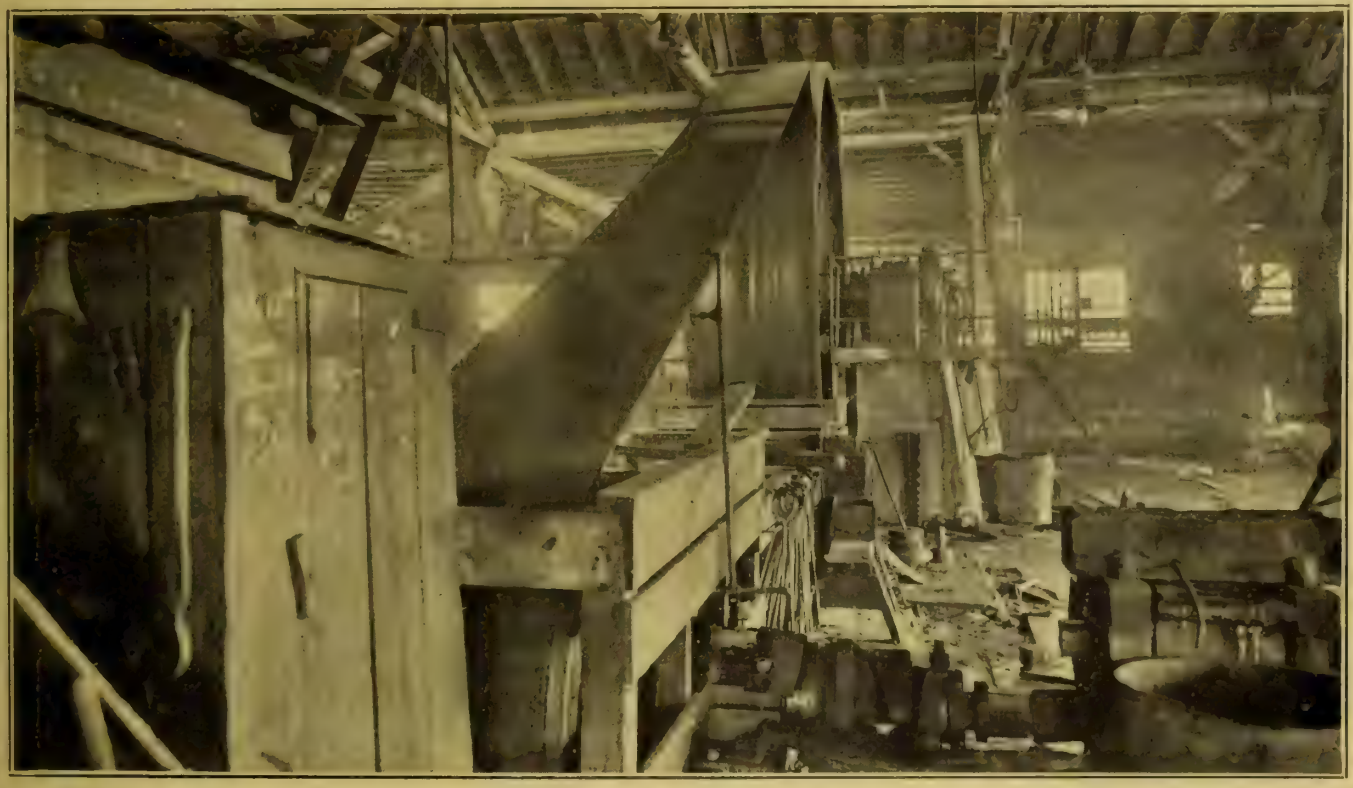
90 Sherbourne St., Toronto **Unity Building, Montreal**

The advertiser would like to know where you saw his advertisement—tell him.

HIGH QUALITY BELTING

Main Drives a Specialty

LEVIATHAN SERVICE



This 38 inch x 10 ply LEVIATHAN BELT replaced a triple leather belt in one of the largest steel plants in Canada at 40% less cost than the best leather. It has also increased the production of the mill by eight to ten tons per day.

THE REASON

LEVIATHAN has far more traction power, more pull and less slip.

LEVIATHAN is not affected by atmospheric changes and conditions.

LEVIATHAN can be run slacker than leather, thus putting less strain on the bearings.

LEVIATHAN has no joints to separate or peel, and its traction power exceeds that of the best leather. We guarantee every **LEVIATHAN** BELT, or money refunded. Why not give us a trial order and let **LEVIATHAN** prove its worth.

When ordering give diameter of Driven Pulley, diameter of Driving Pulley, and approximate Horse Power to be transmitted.

Immediate delivery of all sizes, one inch four-ply to thirty-eight inch ten-ply.

Our bi-monthly belt magazine "**The LEVIATHAN**" is sent free to all men interested in better belting results. Write us and we will put you on our mailing list. Write us now.

MAIN BELTING CO. of Canada, Limited

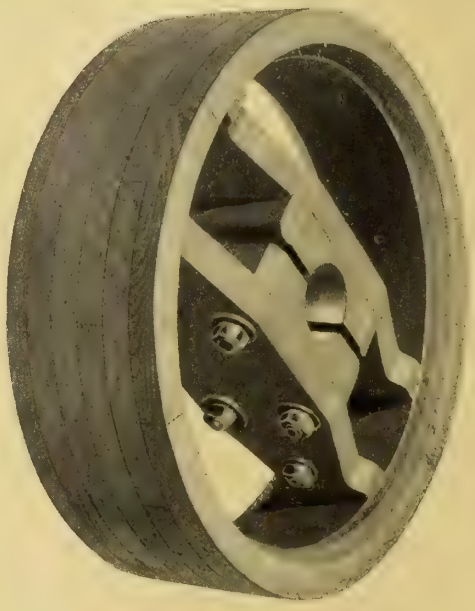
MONTREAL
10 St. Peter Street

TORONTO
28 Wellington Street W.

The advertiser would like to know where you saw his advertisement—tell him.

Elmira Products

Do Their Share
To Minimize the
COST
Of Power
Transmission



"Elmira" Wood Split Pulleys

"Elmira" Pulleys have been placed on the market after a thorough study of the transmission problem.

They pass through the most rigid and exhaustive tests; we place our final O.K. as per quality and efficiency.

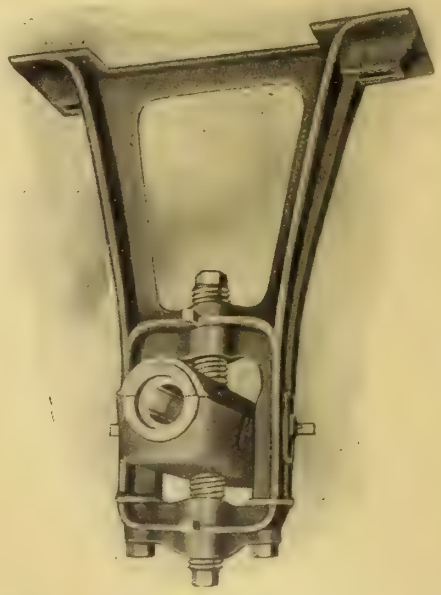
You can use an **"Elmira" Pulley** any place that a leather belt will give satisfaction, and know that what any good pulley will do, it will do, and more.

Many Elmira Pulleys are used on main drives and under other exacting conditions with perfect satisfaction.

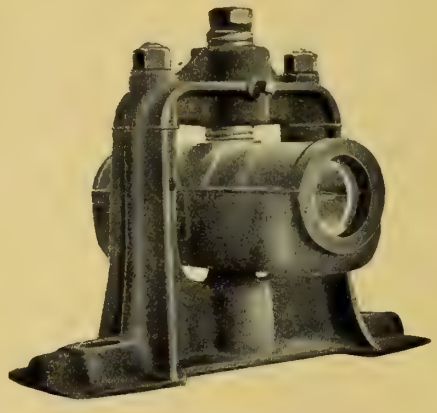
The "Elmira" Line of Hangers is without doubt the heaviest and strongest on the market.

In the Elmira Hanger a union system of oiling is employed, a combination of centrifugal and capillary attraction, effected by tempered steel rings and woven cotton wick. This method guarantees a thorough distribution of lubricant, and precludes the slightest possibility of "Dry Bearings" so long as any oil remains in reservoir or oil chamber, one filling of which should last from six to twelve months.

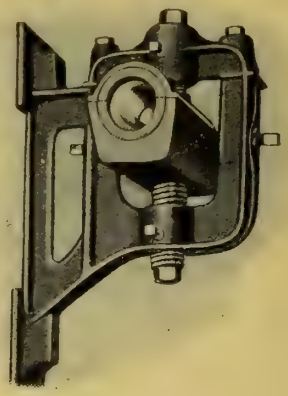
Write for illustrated catalog "C."



"Elmira" Combined Capillary and Ring Oiling Hangers.



"Elmira" Adjustable Ball and Socket Pillow Block.



"Elmira" Adjustable Ball and Socket Post Hanger.

The ELMIRA MACHINERY & TRANSMISSION CO., Limited
ELMIRA ONTARIO

Large and complete stocks carried at Elmira, and by
The A. M. ELLICOTT CO., 301 St. James Street, Montreal, Que., Sole Eastern Agents.

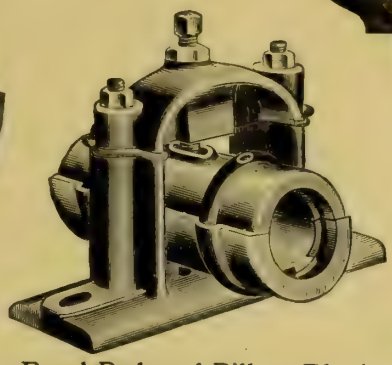
BOND

DOUBLE-SURE TRANSMISSION

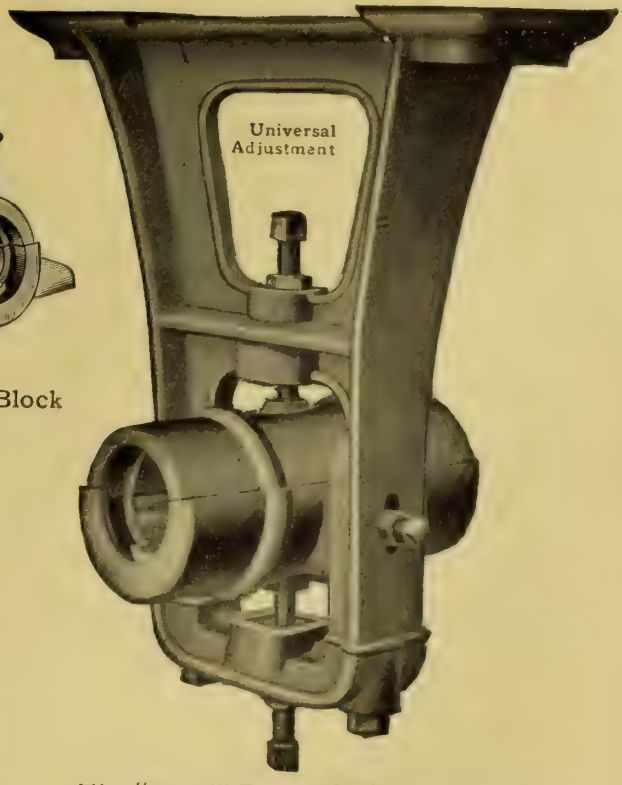
TRADE MARK BOND DOUBLE-SURE QUALITY PATENTED

All Bearings Babbitted **All Bearings Reamed**

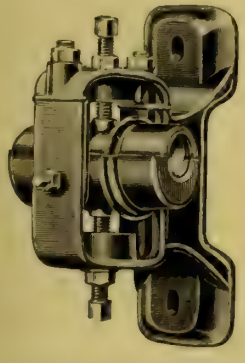
Bond Rigid R.O. Post Box



Bond Pedestal Pillow Block



The "Bond" Patent Universal Ring Oiling Ball and Socket Hanger



Bond Post Hanger

When you buy a "Bond"—you buy the assurance of reliable, efficient and economical service.

Give "Bond" Hangers and Couplings a trial and you will soon be convinced that they are **superior** to other makes.

Send for complete catalog No. 25.

The "Bond" Patent Spiro Compression Coupling

50% more gripping force than any other Compression Coupling.

Canadian Bond Hanger & Coupling Co, Ltd.

Manufacturers

ALEXANDRIA ONTARIO

The advertiser would like to know where you saw his advertisement—tell him.

DICK'S

Balata Belting

Specially Distinguished for the following Important Qualities

Great strength and durability.
Perfect uniformity throughout, whereby true and steady running is ensured, fraying at the edges rendered impossible, and perfect success in fork driving guaranteed.

Complete immunity to water, steam and changes of temperature.

Strong gripping power, ensuring the transmission, positively without loss, of the whole power given off by the engine.

Entire absence of stretching or slipping.

Every Belt sent out is **guaranteed to give complete satisfaction,** otherwise we will take it back and cancel any charge.

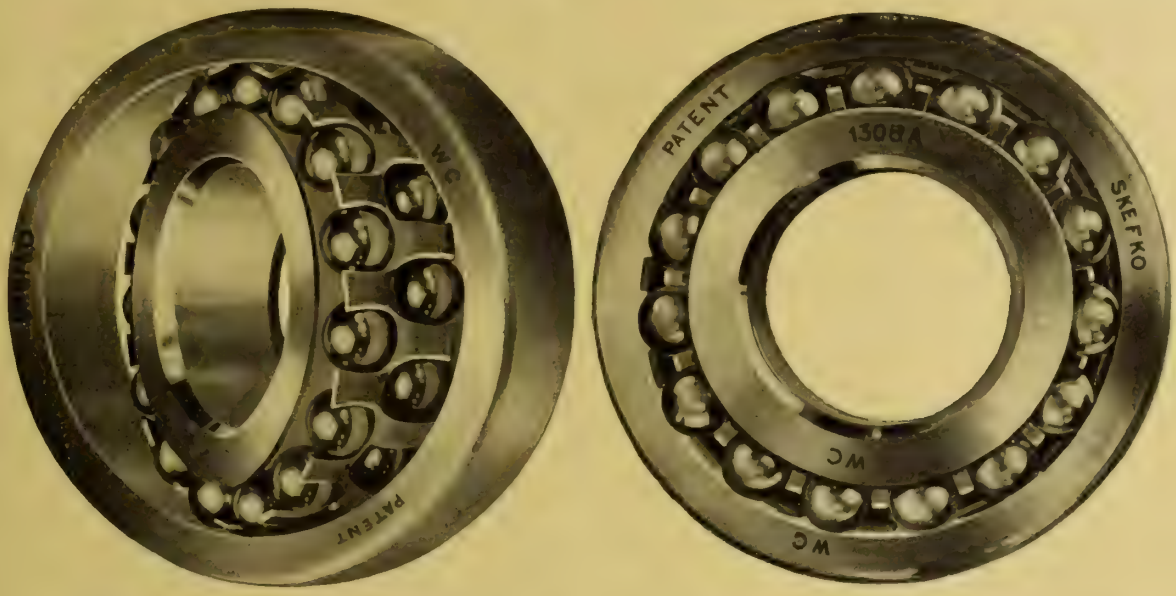
Used by the largest concerns everywhere.

Give it a trial.

The Canadian Fairbanks-Morse Company, Limited

MONTREAL	WINNIPEG	ST. JOHN
CALGARY	OTTAWA	SASKATOON
TORONTO	VICTORIA	QUEBEC

No User of Ball Bearings Can Afford to Neglect these Points



1. **Double Row of Balls**—virtually two bearings in one, a splendid feature under any load condition.
2. **Pressed Retainer in One Piece**—made from Swedish Lancashire Iron. No rivets, wires or screws to work loose, jam balls, disarrange spacing or make noise.
3. **Outer Race Spherical**—providing for a frictionless self-alignment that absolutely and automatically compensates for shaft spring.
4. **Best Swedish Crucible Steel**—Carefully heat-treated and uniform in hardness throughout. Unequalled for toughness, carrying capacity, accuracy and durability.

SKEFKO

is the only truly self-aligning bearing. This feature alone is worth most careful consideration.

¶ SKEFKO Self-Aligning Double Row, Double-Capacity, Double-Life Ball Bearings cost no more and are made in international standard sizes. Their use is practical under any speed and load condition and the lubrication and protective housing can be made to conform to any service requirements.

¶ SKEFKO Bearings are the recognized standard and are replacing other constructions in many types of machinery.

¶ Our literature explains these matters in detail. Your best interests demand that you investigate. Tell us your bearing troubles and ask for our bulletins.

SALES AGENTS

The Canadian Fairbanks-Morse Co.

Limited

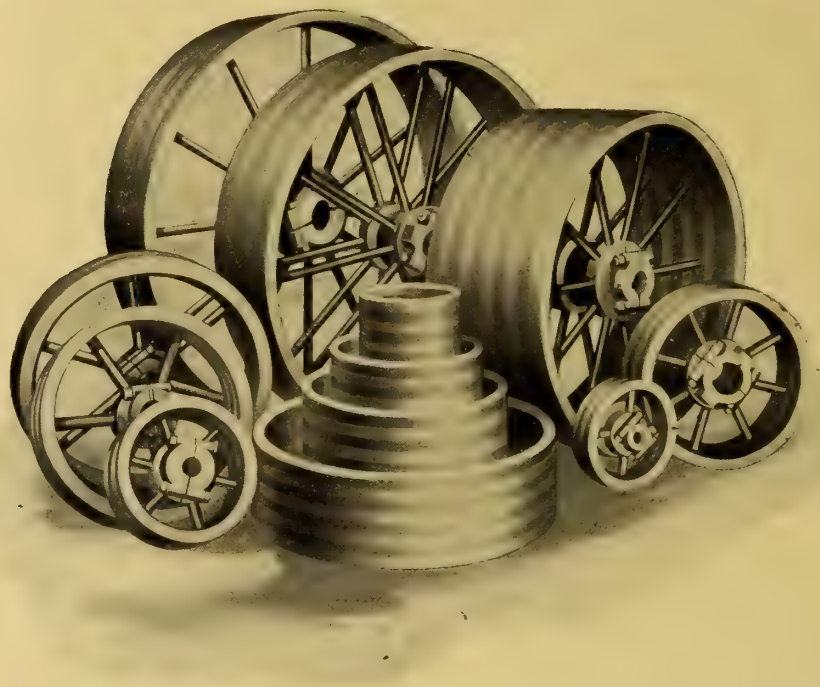
ST. JOHN QUEBEC MONTREAL OTTAWA TORONTO
WINNIPEG SASKATOON CALGARY VANCOUVER

The advertiser would like to know where you saw his advertisement—tell him.

POWER TRANSMISSION APPLIANCES

Wood-Rim Split Pulleys; Iron Pulleys; Bearings; Couplings; Friction Couplings; Spur, Bevel and Mitre Gears; Steel Shafting in all Diameters.

PULLEYS



PULLEYS

Illustration shows a group of our single and double Arm Wood-Rim Split Pulleys. These Pulleys are of a specially strong design, and are so constructed that the arms do not act as a fan, and *the Hubs have an absolutely Positive Grip on Shaft.* We shall be glad to furnish further information to anyone interested.

THE GOLDIE & McCULLOCH CO., LIMITED

Head Office and Works: GALT, ONTARIO, CANADA

TORONTO OFFICE: 1101-2 Traders Bank Bldg.
WESTERN BRANCH: 248 McDermott Ave., Winnipeg, Man.
QUEBEC AGENTS: Ross & Greig, 412 St. James St., Montreal, Que.
BRITISH COLUMBIA AGENTS: Robt. Hamilton & Co., Vancouver, B.C.

Power Generation Equipment Features, Dam 5, Trenton, Ont.

By Chas. W. Byers

Since the advent of the Electric Power Co., in the Bay of Quinte district of Ontario, about 3 years ago, over 300 miles of 44,000 volt transmission lines have been erected, with the result that a large number of towns, centering on Peterborough, are now receiving a 24-hour day supply of both electric light and power. The present Article deals with the latest addition to the Company's plant.

ON THE Trent River at Frankford, Ont., immediately above where the river flows into the Bay of Quinte, the Dominion Government have constructed a dam, at an end of which is located the new power house of the Sidney Electric Co., a subsidiary of the Electric Power Co., of Toronto. This dam is part of the work undertaken by the Government in connection with the Trent Canal, a waterway connecting the Georgian Bay with Lake Ontario. It is known as Trent Dam No. 5.

In the power house there are installed 4 vertical double runner turbines, each having a capacity of 1,200 h.p. at 112 r.p.m., and driving a vertical shaft, 7,000 volt, 60 cycle, 3 phase generator of 650 k.w. at 80 per cent. power factor. The generators are designed to carry a 25 per cent. continuous overload without excess heating. There is no special head race or tail race. The intake is fitted with steel racks to keep out driftwood, etc., and there is a motor-operated emergency gate which can be dropped in front of each wheel in a couple of minutes.

Equipment Features.

The turbines are set in open flume, and are of the twin vertical type, direct connected to the generators by means of clamp couplings of cast steel. The discharge, as shown in Fig. 4, is common for both wheels, and is carried off by concrete draft tubes. The gate mechanism is of the movable type, and has the special feature that the turbines are provided with solid stays of cast iron, connecting the upper and lower vanes, thus forming a solid and substantial frame for the latter. The thrust bearings, of the self-aligning type, are designed to take the weight of the alternator, as well as that of the turbine. Part of this weight is, however, eliminated by means of a balancing device which carrys about ten tons, or one-fourth of the total. These bearings have proved entirely satisfactory, a maximum temperature of only 36 deg. having been recorded without the cooling coil service with which they are fitted being requisitioned.

The automatic oil pressure governors, shown in Fig. 3, are of the self-contained type, and are direct connected to the gate shafts by means of clamp couplings. This design does away with all intermediate links and levers, and prevents lost motion. The effective closing time of the governor is thus reduced to a minimum, the "dead time" being practically eliminated.

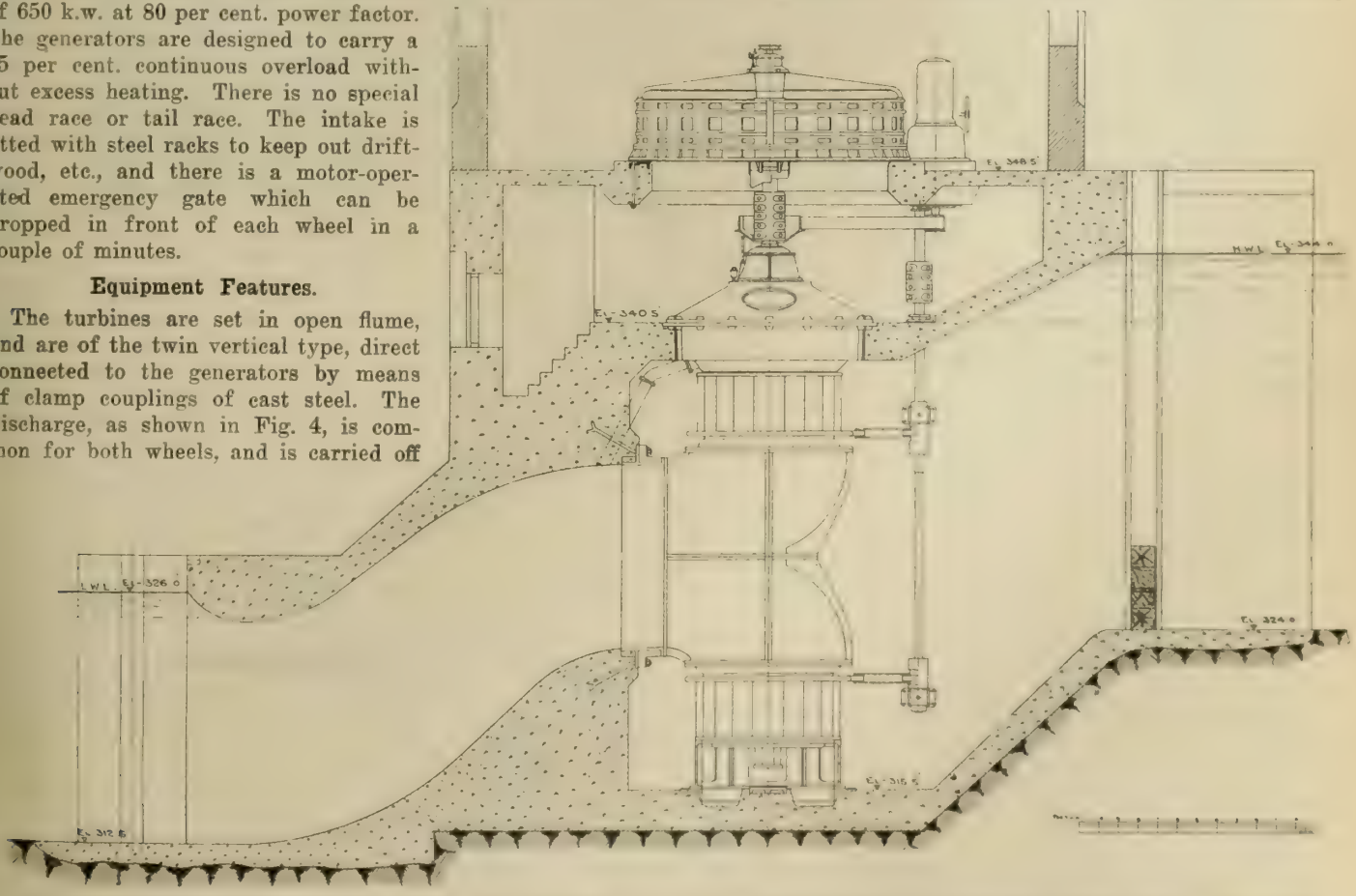


FIG. 5. SECTIONAL ELEVATION SHOWING ARRANGEMENT OF EACH GENERATOR AND TURBINE RELATIVE TO ITS INLET AND DISCHARGE.

Governor Mechanism.

The governor mechanism consists of an oil tank, forming the base, and of a Servo-motor cylinder with differential piston, connected by rod and lever with the regulating shaft which, is coupled direct to the turbine gate shaft. It also includes a rotary pump, driven by belt from the turbine shaft. This takes the oil from the tank and forces it into the air vessel or pressure accumulator. A pilot valve, distributes oil to the Servo-motor cylinder, while a spring pendulum, driven by belt from the turbine, is connected by lever to the relay piston of the distributing valve. A return or overtaking gear connects the regulating shaft to the distributing valve in such a manner, that a certain position of the pendulum corresponds always to a given position of the Servo-motor and regulating shaft. A hand-wheel adjustment allows the position of the fulcrum in the middle of the lever

connecting the pendulum sleeve to the distributing valve to be altered, thus varying the speed of the turbine. This operation can also be performed electrically from the switchboard. The mechanical hand regulating gear consists of a hand wheel operating the regulating shaft through worm gearing. The worm spindle is carried on eccentric guides operated by a handle, through which the worm can be put in or out of action at any position of the gates. A by-pass valve, through which the Servo-motor cylinder is put in communication with the oil tank when the hand regulating gear is being connected, thus putting the automatic control out of action; a spring loaded safety or overflow valve, fitted between pump and tank, by means of which the oil pressure and the energy of the Servo-motor can be adjusted, and an indicator on the regulating shaft, showing the opening of the turbine gates, are some other prominent features of the governor equipment.

The governors and turbines, main and exciter were supplied by the Canadian Boving Co., Toronto, and are, in every respect, duplicates of those supplied by them for Trenton Dam No. 2 in 1911.

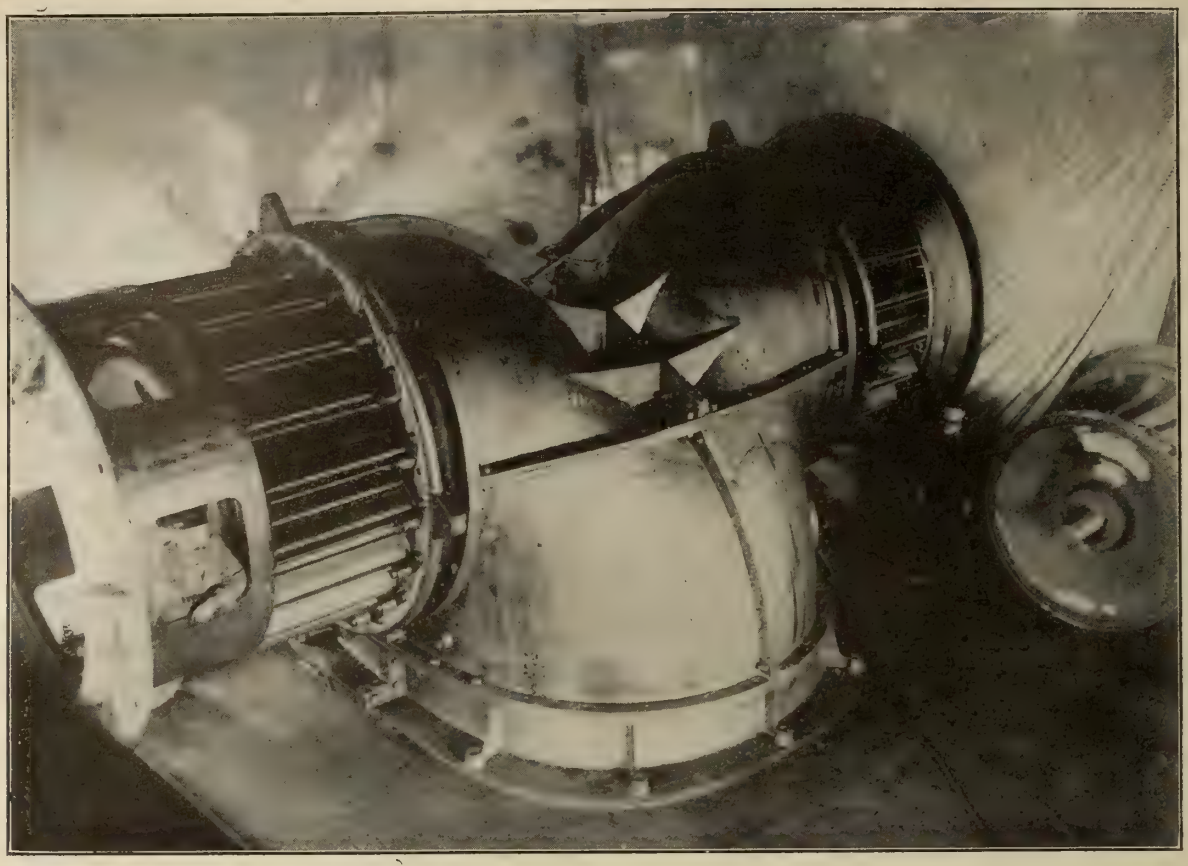


FIG. 4. 1 200 HORSE-POWER VERTICAL TYPE DOUBLE RUNNER WATER TURBINE.

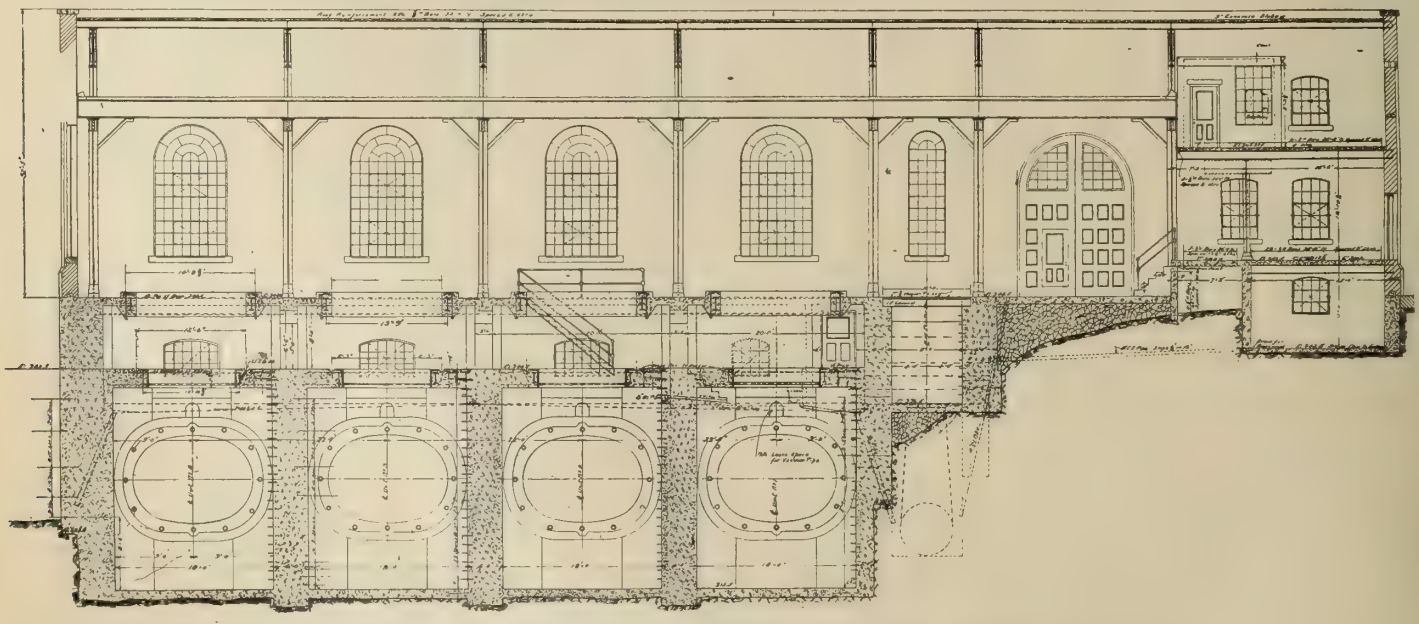


FIG. 8. LONGITUDINAL SECTION ON CENTRE LINE OF POWER GENERATION UNITS.

Exciters and Generators.

Each exciter consists of one 75 k.w., vertical, compound-wound, 125 volt d.c. generator, driven by a vertical turbine. There is also a 75 k.w., 125 volt exciter,

driven by a 2,400 volt induction motor. The generators and exciters were furnished by the Swedish General Electric Co., through their representatives, Kilmer, Pullen & Burnham, Ltd., Toronto.

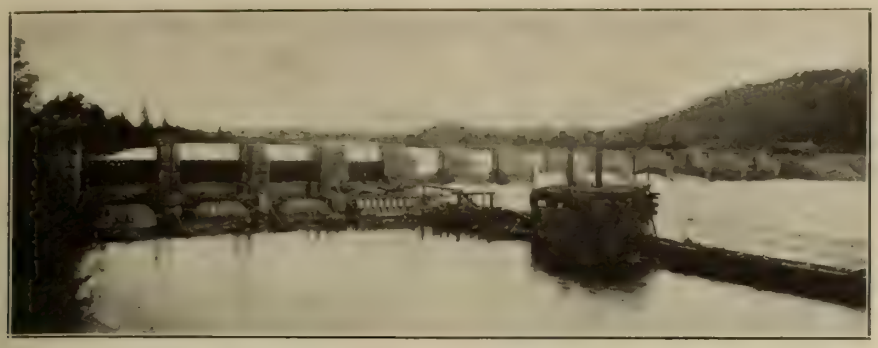


FIG. 1. DAM NO. 5 AS IT LOOKED IN JULY, 1912.

The four main generators, as will be seen from the accompanying illustrations of the power house, are arranged in a straight line lengthways; Next come the exciters, and then, raised 4 feet above the level of the generators, is the switchboard. This latter consists of a panel for each generator and the exciter. The cables from the machines to the switchboard are carried in vitrified clay duct. The switchboard was furnished by the Monarch Electric Co., of Montreal.

Power House Features.

The power house is 30 feet wide, 150 feet long, and 31 feet high. In a basement under the switchboard there is installed a small motor driven air compressor, used for cleaning the generators. A gallery over the switchboard contains an office, the lightning arresters, and the generator field rheostats. A complete oiling system with filter is installed. The power house is served with a 20-ton Northern crane, the hoist of which is operated by a d.c. motor. The crane is traversed by hand, and is the product of the Advance Machine Co., Walkerville, Ont.

Three oil-insulated 75 k.v.a. transformers, supplied by the Canadian General Electric Co., are used to step-down the current from 7,000 to 2,400 volts, for driving the exciter, and furnishing the auxiliary and the station lighting. The panels deliver power to the line at 7,000 volts, at which pressure it is transmitted over four circuits of 300,000 circular mill stranded aluminum, on single lines of wooden poles, a distance of 5 miles to the transformer station at Dam No. 2, about one mile north of Trenton, at which point it is stepped up to 44,000 volts for distribution over the Electric Power Co.'s system. The transformer station contains three 3,000 k.v.a. 60 cycle, 3 phase, water-cooled transformers, which are used to step up the output of the various power houses in the vicinity of Trenton, from 7,000 to 44,000 volts.

On the Electric Power Co.'s system, there is in operation about 300 miles of 44,000 volt transmission line, serving practically all the towns and cities of importance in Central Ontario, from Whitby to Napanee, and as far north as Lindsay, Peterborough, and Madoc. The power is distributed to about twenty cities and towns in this district, and to various industrial establishments such as cement mills, rock crushing plants, etc.

FIG. 6. THE POWER HOUSE AT DAM NO. 2.

Two More Power Houses.

The load on the system is 15,000 h.p., but this is steadily increasing, and to

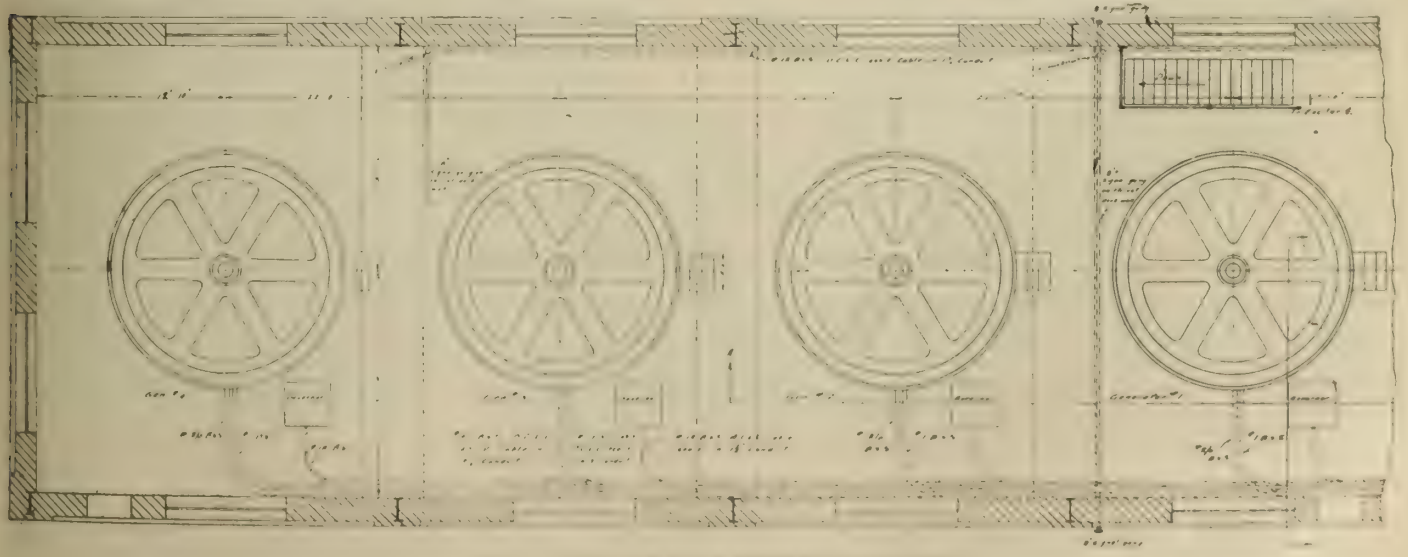


FIG. 9. PLAN ON MAIN GENERATOR FLOOR.

take care of this increase, two new power houses are now under construction, one of these being at Healy Falls, 6 miles north of Campbellford, where a head of 76 feet is obtained on the Trent River. This power house will have a capacity of 20,000 h.p., and is expected to be in operation before the end of this year.

FIG. 2. DAM NO. 2, ONE MILE NORTH OF TRENTON, WITH TRANSFORMER HOUSE ON LEFT.

Three years ago, a load of a few hundred horse power, marked the beginnings of the Electric Power Co. in this field; since which time its growth has been rapid. Many of the towns and cities at that time had simply a lighting service, and several had no electrical supply whatever. They have now a 24 hour service, with ample supply of power, in addition, for the use of present and prospective industries. Rural district lines are also being built, some of which are already in operation. These will supply power and light to farmers in various parts of the territory covered by the system. It is expected that a largely increased mileage of these lines will be put into operation during the next year or two.

The work on the power house at Trenton No. 5 Dam was commenced during the fall of 1911, work on the dam being started by the Government somewhat earlier. The station was put into operation quite recently. The installation was designed by Smith, Kerry and Chase of Toronto, and the construction work was carried out by the Midland Construction Co. Mr. A. L. Mudge and Mr. N. R. Gibson had charge of the electrical hydraulic sections, respectively. D. R. McKinnon is the resident engineer.

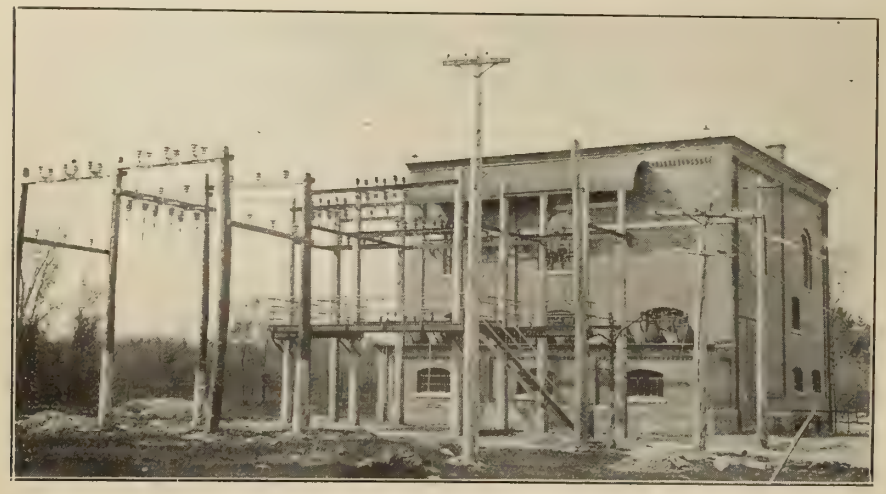


FIG. 7. TRANSFORMER HOUSE AT DAM NO. 2.

ELECTRIC DRIVING IN TEXTILE MILLS.

AN interesting article appeared recently in the "Yorkshire Observer" on electric driving in textile mills. We extract some passages relating to the advantages of the direct electric drive for textile work:—

Investigations have been made bearing upon the use of small motors driving directly on the machines themselves without intervening transmission devices, and after many vicissitudes, and in the face of a complete apathy on the part of conservative mill operators and not a little active opposition from machinery manufacturers, a great amount of data and information has been secured, showing that the direct drive is eminently desirable. Textile machinery is run at high rotating speeds, and an absolutely steady and uniform rate of rotation is demanded for the best production.

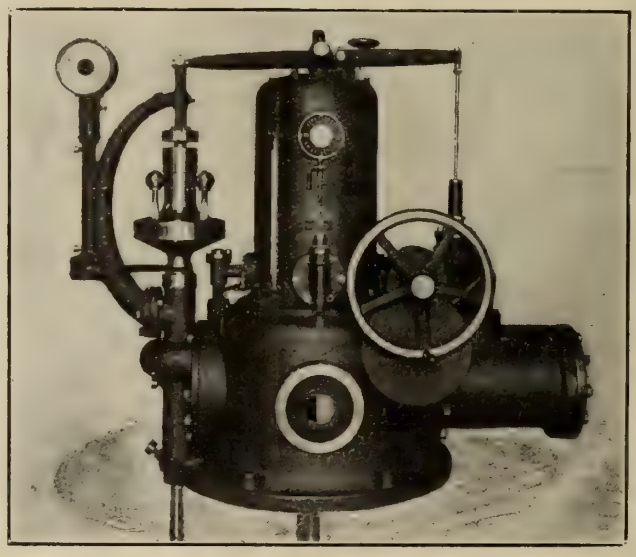


FIG. 3. AUTOMATIC OIL PRESSURE GOVERNOR.

The cotton ring-spinners were the first to develop the individual drive, as the speed of driving the cylinder was conducive to direct connection to alternating current motors. Several large cotton ring-spinning mills have been equipped upon this system, and the results obtained are all that could be desired, because with the turbine as the prime mover beyond the motors, the speed variation has been found to be not greater than 1 per cent. from the normal. The motor is controlled by a special enclosed oil switch mounted at the end of the spinning frame, and can be operated either from any point along the frame, or automatically, as desired.

Seeing that successes have been met with in the operation of the individual drive in cotton mills, it is somewhat surprising that more attention has not been given to the driving of the spin-

ning frames by this method in the worsted industry, even though high rotative cylinder speeds are not met with in the latter.

Individual Drive Developments.

Perhaps the most surprising of all the developments is that of the individual drive of silk, worsted, woolen and cotton looms. Here the parts are reciprocating and the rotative speeds are lower, but the benefits from a perfectly uniform speed are most marked, for, on account of the possibility of making closer speed adjustments, there is much less breakage of loom parts. Although the principal effort in developing these drives was originally expended in the cotton industry, they have become no less popular in the woollen, worsted, and silk mills.

Owing to the importance of good speed regulation, the loom has presented in all branches of the industry an exceptional opportunity to display the good points of the small motor drive. The advantage of this drive was soon realized, especially in the silk industry, because the product of that industry is so valuable that improvements in weaving are of importance, and particularly because oil drippings from overhead shafting cannot so easily be removed as from cotton or worsted.

In any event, an immense number of cotton and silk mills now consider this the standard drive, and will instal no other. The motors have a very high efficiency and starting torque, and are either geared to a large friction clutch which disengages from the loom upon stopping, thus effectually removing all shock from both motor and loom, or a belt is used, the motor being arranged so that all slack may be easily taken up when desired. A special switch controlling the motor circuit is simultaneously and automatically opened, so that the power consumption stops when the loom ceases operation.

Power Transmission Benefited by Belt Treatment

By C.T.R.

It cannot be too forcibly impressed on the minds of users of belting that proper treatment of and consideration for this drive medium, not only prolongs the life, and, therefore, reduces the upkeep cost, but at the same time reduces the operating expense by eliminating abnormal friction and reclaiming lost work.

PROF. Thurston, the great authority on friction and transmission, says in his book "Friction and Lost Work" that the power loss in mills and shops ranges from 5 to 70 per cent. Kent quotes a loss of 25 to 39 per cent. of the total power in the shafting alone. It is the duty, therefore, of the engineer and belt man to cut down these losses as much as possible by proper lubrication and adjustment of bearings, by proper alignment of shafting, and by proper care and maintenance of belts and pulleys. The most important item of them all is the belt, because, where wear in bearings is excessive, it is usually due to tight belts. Again, where shafting is unduly sprung, a belt is usually the cause, and where slipping and screeching occur, the belt is invariably to be blamed.

In Prof. Goodman's text "Mechanics Applied to Engineering" it is shown that if properly lined up, a solid shaft with ordinary bearings would transmit power a distance of 6,000 ft. with an efficiency of 80 per cent., when all forces

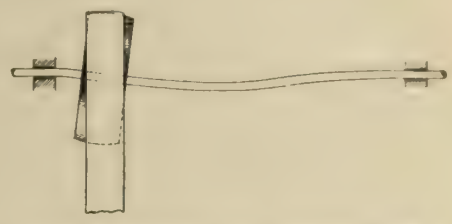


FIG. 2. EXAGGERATED EFFECT OF A TIGHT BELT.

are purely torsional. With belts, in which bending and torsion are necessarily combined, that distance drops to 400 ft.; still 400 ft. is a much greater distance than is accomplished by shafting under ordinary conditions with efficiency of 80 per cent.

Many belt drives are arranged as shown in Fig. 2, with only one hanger to give rigidity to the driven pulley. In practice, the deflection is not as marked as shown here, but the slightest deflection seriously affects the transmission efficiency as Prof. Goodman indicates. In operation, the shafting maintains that form, and the friction increases with the amount of deflection. It is necessary then to reduce the belt tensions as much as possible, and the only way to do this efficiently is to properly treat the belt.

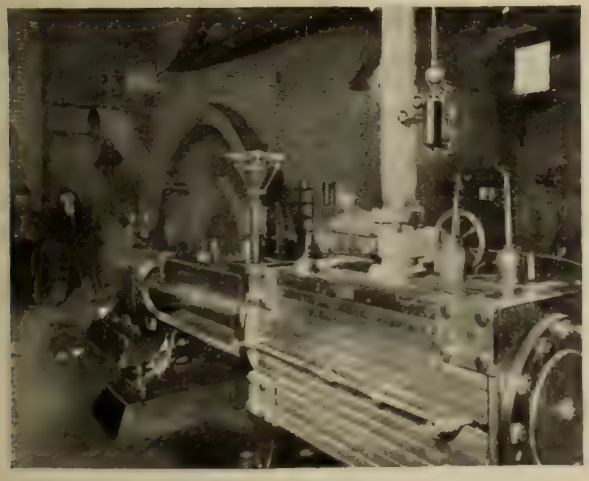


FIG. 3. TYPICAL EXAMPLE OF BELT DRIVE UNDER NON-SLIP TREATMENT.

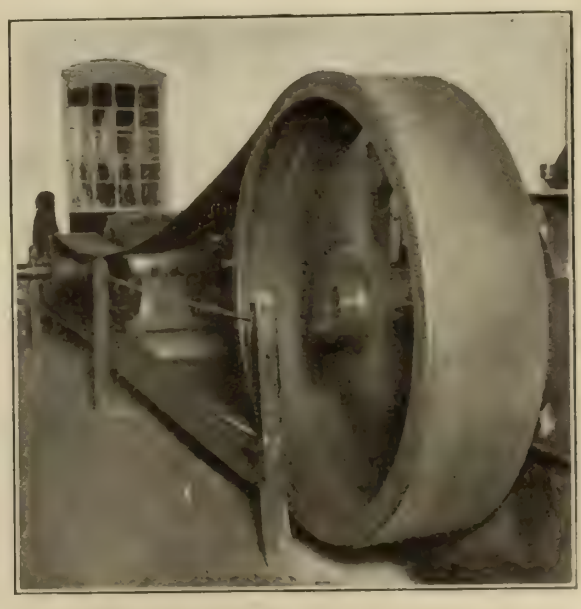


FIG. 1. TYPICAL EXAMPLE OF BELT DRIVE UNDER NON-SLIP TREATMENT.

Leather Belting Features.

Since leather belts are made up entirely of small fibers, it is the action

of the fibers that must be studied. As soon as understood they can be given intelligent protection. When anything is bent, internal friction is brought into play somewhere. This is proved by the increase in temperature of rods while bending. When a belt is bent, every fiber is forced to rub against its neighbor. It is the fibrous construction of a leather belt that makes it porous. These pores or spaces may be easily filled with any fluid substance, and unless first treated on the outside and well filled with some substance that resists moisture, the latter will easily get in and out. Alternat wetting and drying shortens the life of any kind of leather, as wearers of leather shoes or gloves well know. When proper treatment is applied it serves more purposes than one. In occupying all the spaces in the belt, it surrounds every fiber and acts as a preservative lubricant for the fibers when one rubs against the other in bending. An untreated belt wears out more quickly than a treated belt, because in bending the gradual grinding of the fibers hastens internal wear. Besides, selected treatment gives a leather belt the kind of flexibility needed to insure non-slipping—a modern feature clearly shown in the photographs.

Painted Cotton Belts.

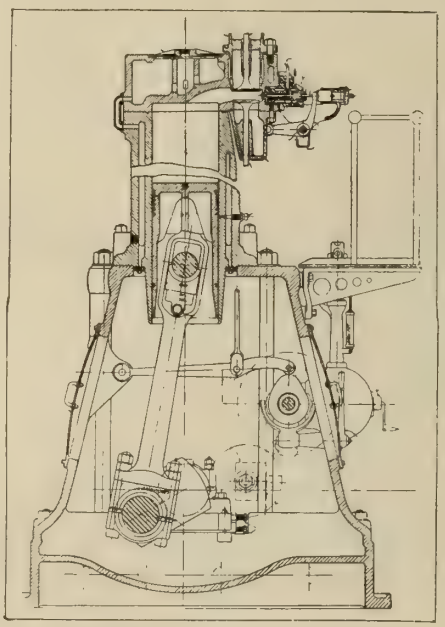
When new, painted cotton belts are fairly waterproof owing to the filler that is in them, and the paint on the outside. After being used for a short time, however, this gummy filler on the inside soon dries and cracks. The paint outside also wears or falls off, while fissures appear at the edges, and the fabric becomes filled with minute cracks which alternately gape open and chafe together as the belt goes around the pulleys. It is then an easy matter for water to get in through the openings made, but not so easy for it to evaporate or get out; hence such a belt may rot in a short time. A waterproofing preservative will enter all of these openings, and easily make the belt as waterproof as it was when new, improving and rendering it more serviceable, and making it more waterproof every time an application of the preservative is made.

Unpainted Cotton Belts.

A more troublesome belt is found in the unpainted cotton belt. An unpainted cotton belt is like a clothes line; with every atmospheric change it expands or contracts. However, when these belts are properly treated they are made absolutely waterproof, because there are no glued laps, and because they are already filled with an impervious filler. The preservative readily penetrates between the fibers, mats them together, makes a heavier belt, more dense, with less stretch, with no possibility of cracking and absolutely waterproof. This is a good belt for many purposes and low-priced. The well stitched canvas belt made of piles of canvas is preferable to the woven webbing form of belt, as it stretches less and has more weight and density when waterproofed. A heavier belt is desirable because initial tensions can be readily reduced; if the initial tension is needed it is created by the weight of the belt itself.

Camel Hair Belts.

Camel hair belts when new and through life are much better than ordinary unpainted cotton belts, because they are denser, heavier, and tougher, yet they are similar in behavior to cotton belts either plain or painted, and can be made equally waterproof.



AN AMERICAN DIESEL ENGINE.

Rubber Belts.

When new, rubber belts are quite able to resist water, but after being used for a short time they develop pin holes through which moisture is admitted, and, as in the case of the painted cotton belts, the water cannot get out, it rots the canvas. A preservative should be used in this case, also, to fill up these holes.

The photographs given herewith show belts in actual operation in two different plants, pulling loads that tax their full strength, yet they pull their loads with apparent ease. It is evident that a load pulled in this way reduces the shaft deflection to a minimum and thus increases the shaft's efficiency, the total pull being exercised in doing useful work. If the belt elongates, all the better, for the arc of contact is increased, thus maintaining high belt efficiency.

All of these advantages, and, not least, that due to waterproofing, are worthy of earnest study. There is much to be gained in improving boiler, engine, dynamo, and motor efficiencies, but unless belts are properly cared for, that gain is lost in the shafting and never gets to the machinery. Modern belt treatment is largely responsible for the high belt and shaft efficiencies found in the most carefully planned and managed shops of to-day.

We are indebted to the Cling-Surface Co., Buffalo, N.Y., for the illustrations accompanying this article.

TEST OF AN AMERICAN DIESEL ENGINE.

SOME tests were recently carried out by Professor A. C. Scott on a 225-brake-horse-power Diesel engine at the Hugo (Okla) Ice and Light Co.'s works. The engine was built by the Busch-Sulzer Brothers Diesel Engine Co., of St. Louis, U.S.A. Six test runs were made, each at a different load, and as the engine was from time to time required to carry its plant load, the six tests had to be spread over a period of several days. The engine had been in service for about six months, and prior to the tests, no special tuning-up was attempted. The fuel used gave 18,986 B.T.U. per pound. The engine was coupled to a three-phase generator, and the load was adjusted by means of a water rheostat. The air compressor was driven from an outside source, but the power used by it has been allowed for in the test figures.

The consumptions of fuel oil were as follows:—10.8 gallons per 100 brake-horse-power hours at quarter load; 6.8 gallons at half load; and 6.2 gallons at full load. This latter figure corresponds to 0.441 lbs. of oil per brake-horse-power hour. The thermal efficiencies were 17.4 per cent. at quarter load, 27.8 per cent. at half load, 29.5 per cent. at three-quarter load, 30.3 per cent. at full load, and 20.2 per cent. at 10 per cent. overload. The Busch-Sulzer Brothers Diesel Engine Co., who built the engine, are erecting a large plant at St. Louis to be devoted wholly to building Diesel engines. The plant will be put into operation about the beginning of June.

Engineer's Ball.—Members of the International Union of Steam Engineers in Saskatoon, Sask., are planning to hold their first annual ball during the latter part of April. Definite arrangements will probably be made at the next meeting.

Concerning the Transmission of Power by Chain Drive

By H. T. Hildage

The writer of this paper expresses the opinion that the Transmission of Power by Chain Gearing is a matter which all engineers will be compelled to study closely in the near future, and indicates that the subject is one of immediate and special interest to electrical engineers and all who are concerned with the transmission of power from electric motors to machines or line shafts.

CHAIN gearing combines all the advantages of a positive and highly efficient drive with just as much elasticity as is desirable. It allows, also, almost complete freedom as to the position of the motor and its distance from the shaft or machine to be driven, which renders it specially useful and convenient. The connecting link between prime movers and line-shafts, and between line-shafts and machines, in the past has been very much neglected, and is not by any means adequately considered even yet. Steam engine builders, gas engine builders, and electrical engineers have all been striving their utmost to improve the efficiency of the machines they make, but the efficiency of the transmissions between the first mover and the machine to be driven are often the cause of more loss than all the rest of the plant put together. It follows, then, that a means of trans mitting power from engine or motor to line-shaft or to machine that is quite positive, that will ensure from96—98½ per cent. of the power given off by the motor being transmitted to the machine, and that imposes practically no restrictions as regards the relative positions of the motor and the machine, is one that demands earnest consideration.

Development.

Driving chains have been developed by a commercial house, and they owe their origin to the necessity for finding a suitable means of transmitting power from a bicycle crank-shaft to the road wheels. Chain gearing has never been submitted to, and has never received, the attention of independent scientific institutions or authorities, and consequently is not usually accepted as a standard means of transmitting power. Those who speak of it, therefore, and endeavour to impart knowledge concerning it, must necessarily take up more or less, the position of advocates, and in putting forward their claims must speak frequently of the disadvantages of other forms of gearing.

The foregoing, being definitely stated and accepted, it may be a good plan to summarise briefly the advantages of chain gearing.

A Positive Transmission.

(1)—It is a positive transmission, inasmuch as the chain cannot slip over the wheels as a belt does. It is elastic, however, since the weight of the chain which hangs between the wheels may act as a spring; lubrication in the bearings, and in certain cases, even the shapes of the links themselves adding to this quality. The effect of this elasticity is to reduce considerably the vibration and noise which is inseparable from a positive power transmission such as spur gearing. It also has the effect of rendering unnecessary the microscopical accuracy of erection and alignment usually essential to produce high efficiency with tooth gearing of any type.

Highly Efficient.

(2)—It is highly efficient and the efficiency is maintained until it is completely worn off. Experiments have shown that the efficiency of a well-designed chain drive is somewhere between 96—98½ per cent. Tests were made recently, at Faraday House, on a motor car transmission (that of the 8-10 Phoenix motor) consisting of two chain drives and a countershaft. The total loss of power in the two chain drives and the bearing of the countershaft was only 7 per cent. The nature of the action of the chain upon the wheel, as is explained in the description which follows, is such that the high efficiency is maintained until the chain is worn out.

Economical of Space and Light.

(3)—As compared with rope or belt drives, chain gearing is much more economical of space and light. The distance between shafts which is necessary for chain driving never exceeds 8 or 9 ft., and can, if the circumstances require it, be so small that the chain wheels very nearly touch one another. For this reason, it is even possible to take out a pair of spur wheels, replace them by chain wheels of smaller diameter, and get, as the result, a highly satisfactory drive as regards efficiency and absence of noise and vibration. For overhead factory and shop driving, chains and chain wheels are usually smaller in dimensions than the belts and pulleys which they replace, and as the shafts can be placed so much closer together, it follows that in a workshop dependent on overhead lighting, the interruption of light is very much less with chain-gearing than with belting. It even renders possible, in many cases, another form of drive—namely, the placing of line-shafts under the floor, with short drives from line-shaft to machines. This has been taken advantage of in one or two engineering works and textile factories.

Electrical Driving.

(4)—In introducing electrical driving into existing factories, it is very often possible, by the use of chain gearing, to use faster running motors than is the case with belt or rope driving. In order to get ordinary efficient drives with belts and ropes, it is necessary to use quite large pulleys on the driven shafts, and these cannot always be accommodated. These driven pulleys become very large indeed, if the motor is fast-running, and the ratio of reduction a large one. With chain driving, a ratio of reduction of 6: 1 can usually be accommodated with quite small wheels. An example of this was found in quoting for the electrification of a cotton mill in India a short time ago.

Two complete propositions were made:—One for chain driving with fast-running motors and the other for rope driving, using rope pulleys as large as could be accommodated, and motors for the corresponding speeds. Apart from the saving in space effected, the proposition including chain drives was much less expensive than the one including rope drives.

Heavy Incidental Economies.

(5)—There are heavy incidental economies effected by chain driving, partly on account of the advantages above mentioned, partly because it is not necessary that there should be any greater initial tension in the chain than such as is caused by its own weight, and partly on account of the more even turning that is obtained as the result of the drive being positive.

Chain Types.

The bush roller type and silent types, were described in detail by the author, who incidentally remarked that the term "silent" in this connection is merely a comparative one. Some silent chain drives are in truth as nearly silent as could be wished, but others, principally those where small pinions and very high speeds are used, are exceedingly noisy, giving off a loud buzz, which sometimes almost becomes a shriek. The wheel teeth and the chain

teeth on engagement and disengagement are moving at the same peripheral speed but differing angular velocities. The smaller the wheels, the greater will be the difference between the angular velocity of the wheel teeth and the chain, and it is this differing angular velocity that causes what slight impact there is, and is responsible for the noise mentioned.

In the course of further observations, the author remarked that it is better to use a chain of the poorest type than not to use a chain at all.

The Guiding Feature.

Silent chains are guided in three ways:

(a)—By flanging one of the wheels.

(b)—By a running flange in the chain which runs in a groove on the centre of the wheel.

(c)—By running flanges on the outside edges of the chain which overlap the edges of the wheel.

Perhaps the most generally satisfactory of these three methods, but certainly the most expensive, is the flanging of the wheels. Any end play in the shafts, or difficulty in aligning the wheels properly, can be allowed for by making the wheels extra wide, and faults in alignment or parallelism do not lead to such rapid destruction of the chain as is the case with other methods of guiding.

Comparison of Silent and Bush Roller Chains.

The silent chain is a much more delicate piece of mechanism than the bush roller chain, and must consequently be much more delicately handled. As a matter of fact, the bush roller chain is the chain that is always selected for difficult situations, hard service and rough usage, and under such conditions it is capable of doing wonderful work. The silent chain gives slightly smoother turning, runs much more quietly and can generally be used at higher speeds. It is the chain that is usually selected for use with electric motors, and for all cases where quiet and smooth running is necessary at moderate speeds.

The roller chain is generally used for low speeds, say up to about 600 ft. per minute. It is also used, however, when the speed is far outside the ordinary range. For example, it is the roller chain that is used for aeroplane work, where the linear speed often exceeds 2,000 ft. per minute. The objection to using a silent chain for such cases is its weight, which is undesirable in aeroplanes and airships, and also induces great centrifugal tension and loss of efficiency. The economical limit of speed for silent chains is about 1,300 ft. per minute. In special cases this may be exceeded with safety, but not with economy. A little calculation will readily convince one that the tension in the chain increases more rapidly due to centrifugal force, than it diminishes on account of the increase of speed for transmitting a given power.

Silent Chain—Speed and Ratio.

For the silent chain, the speed should not exceed about 1,300 ft. per minute, and the pinion should always have at least 13 teeth, and if possible 17 teeth or 19 teeth. With a tooth angle of 60 degs., which is pretty generally adopted by chain manufacturers, it is possible to cut a pinion having as few as 13 teeth, and such a pinion can be used in extraordinary cases, but for economy, durability and quietness, 17 teeth or 19 teeth are much better.

The driven wheel should not, as a rule, have more than 100 teeth. There is no practical limit, of course, to the number of teeth that can be cut, but a little study will show that the power of the chain to adjust itself to a larger pitch circle, when its pitch has increased by wear, varies inversely with the number of teeth in the wheel:

Let (p) be the pitch of the chain, and (x) the increment of pitch after the chain has worn some time, and (0) be the angle in degrees between two neighboring teeth on the wheel; then (0) will equal $\frac{360}{N}$ where N is the number of teeth.

If (h) be the distance between the position of the chain on the wheel teeth before it has worn, and afterwards, then $(x)=h.\sin(0)$ approximately.

The possible rise of the chain on the teeth depends on the depth of the tooth, and is nearly constant for all sizes of wheels of the same pitch. It follows that the maximum amount by which a chain may wear, and still remain in gear with the wheel, diminishes rapidly as (0) diminishes, and consequently as the number of teeth in the wheel increases.

Roller Chain.

It has already been stated that the roller chain is most suitable for low speeds, that is to say, up to about 600 ft. per minute. It can be used on wheels having as few as 8 teeth, and as many as 80 teeth. It is more unsatisfactory to use a roller chain on small pinions at high speeds than to use a silent chain under these conditions, because not only is the roller chain noisier and more severely worn, but there is a decided impact at its entry upon the pinion, and if the pinion be small and the speed high, this impact may be sufficient to cause breakage of the rollers, which is fatal to the chain.

General.

It is very seldom, indeed, that a drive can be installed under conditions which are ideal in every respect. One drive has a ratio which is rather larger than one would like; another is running at higher speeds; a third has an impulsive load, and in a fourth, perhaps, the shafts are closer together than they should be, and so it goes. If any drive, however, comes up, in which all limitations are exceeded, one has to consider whether it would not be better to find some other way out, or at any rate, one should balance carefully the advantages and disadvantages of different methods. It should be borne in mind always that the effect of ignoring or exceeding the limitations is not, as a rule, to make the drive a failure from the beginning, but to shorten the life of the chain.

Life of Drives.

This, unfortunately, is a subject upon which it is very difficult indeed to give any reliable information. Chain driving has only been in considerable use for a few years, and drives vary in so many points, each of which has its own effect upon the life of the chain, that so far it has not been possible to collect any satisfactory data. The author has under observation, however, a large number of drives, concerning which he is collecting such information as the angular motion that takes place at each chain joint, the bearing pressure on the pins, and the increase in pitch, and when these observations have been continued for a sufficient length of time, some data will be obtained that will make it possible to predict, with reasonable accuracy, the life of any given chain drive. In the meantime, since these three factors are the only ones that matter, it is always possible to make a comparison between any two drives.

The writer has found cases where chains, properly erected and well cared for in the matter of lubrication, have worn out in as short a space as two years, and others that have lasted as long as fourteen years. For example, there are a number of chain drives in the Guardian Printing Works, near Stockport, Manchester, which have been running for twelve years, and are still capable of further service. Some chain drives on the governor of a large steam engine were taken off the other day which had been running for fifteen years.

On the other hand, there were in the works of Messrs. Handiside, of Derby, a number of chain drives on punching and shearing machines which could not be made to last more than two years. As a general rule, the wheels will last about twice as long as the chain in a normal drive. The pinions or small wheels, up to about 25 teeth, are usually made of steel and case-hardened, and the larger wheels should be made from a good grade of hematite iron.

Once the general conditions of the drive are fixed, the only three factors that affect the life of the chain are alignment, adjustment and lubrication.

Motor Drives to Machines.

Individual drives from motors to machines are probably of more interest to machine tool makers and users than to any other class, although they are largely used for almost all classes of machinery.

A horizontal belt drive was replaced by a chain drive on a machine for drilling holes in railway sleepers. Before the chain was fitted, all kinds of belts were tried, and the most successful one seemed to be the type composed of small links of leather running on edge and fastened together by steel pins. After the conversion to chain drive, the machine turned out from 35 to 70 per cent. more work. This was mainly due to the saving of time which had been occasioned by having no belt to look after and repair. Considerable trouble had been experienced with heated bearings whilst the machine was belt driven, and this trouble was entirely eliminated.

A large amount of time which had previously been used in repairing the belt whilst the machine was out of service was entirely saved. The quality of the work was very much better, for the holes in the sleepers were found to be much smoother and rounder in the chain-driven machine than in the belt-driven machine.

The chain speed in this case was rather higher than 2,000 ft. per minute, and in designing the drives it was assumed that the belts were slipping 20 per cent. Experience confirmed the fact that this assumption was entirely justified.

Small Automatic Machine Drives.

In driving some small automatic machines in the works of Hans Renold, Ltd., it was found by measurement that the power absorbed by a chain-driven machine was 26 per cent. less than the power absorbed by a belt-driven machine, and that the wear and tear on the cutting tools was considerably less on chain-driven machines than on belt-driven machines. For instance, a circular parting-off tool was used in both cases, with a usable length of 8 in. In the belt-driven machine, two such tools were required for parting 2,485 rollers. They were ground nine times, and a length of 10½ in. was used. In the chain-driven machine a length of ½ in. only was used for 3,074 rollers, the tool only requiring grinding twice.

Similar economy was found in the drills. In 138 hours a chain-driven machine made 3,074 rollers in the same time that the belt-driven machine made 2,485, which represents an advantage of 23½ per cent. in favor of the chain-driven machine.

The work from the chain-driven machine was considerably better than that from the belt-driven machine, the machined faces showing a much smoother finish; this serves also as an explanation of the fact that the tools used on the belt-driven machine required grinding so much oftener than those used on the chain-driven machine. This test, and the others about to be described, were arranged, as far as possible, to be perfectly fair to both chain and belt.

Two No. 6 automatic gear cutters made by Brown & Sharpe were run on precisely the same kind of work—namely, cutting teeth in cast-iron wheels for 1¾ in. pitch silent chain; a cutting speed of 75 ft. per minute was used—one of the machines being chain-driven and the other belt-driven. On the belt-driven machine it was only possible to use a feed of 3¼ in. per minute; on the next higher feed the belt slipped and the machine jammed, and even at 3¼ in. per minute the belt whipped badly and rattled the overhead gear. On the chain-driven machine a feed of 5¼ in. per minute was easily maintained, showing an advantage in production of over 60 per cent. The increase in power necessary for higher production amounted to 10 per cent.

A further instance is that of a block drilling machine with two horizontal spindles which used to be driven by belt with chain feeds, and a maximum production of nine blocks per hour was permissible. This machine was converted to a chain drive, but the same speed of drill was maintained; after the conversion, it was found possible to obtain a production of 33 blocks per hour without difficulty. The work was of better quality, for the holes in the blocks were much more accurate to pitch on the chain-driven machine, than on a belt-driven machine.

Perhaps this last example is not absolutely fair, because the belt-driven machine had a chain feed, and when the belt slipped the feed being positive would be likely to assist in causing a jam. The experiment is therefore, being repeated with the feeds belt-driven, and some interesting figures will no doubt be obtained.

Positive Drive Feature.

It will be noticed that all these advantages have been obtained in comparison with belts, and the results constitute a very strong argument for a positive drive without necessarily strongly supporting the use of chain gearing in particular. It is the case, however, that almost the only positive drive that can safely and satisfactorily be used in such cases is a chain drive, because spur gearing imposes very narrow limitations as regards centre distance, and in order to get anything like an acceptable efficiency, the gearing must be lined up with great accuracy; the slightest deviation causes noise, vibration and considerable loss of power, and may indeed occasion actual damage.

An example of this may be mentioned. A high-speed vertical engine was driving through a pair of helical wheels to a mill shaft taking about 250 h.p. Also driving on the same shaft was an old-fashioned beam engine, and the two engines were used alternately for driving the mill and also for driving a generator on the other side of the high-speed engine. One of the helical wheels, of course, was on the crank shaft of the engine, and the other on the line shaft, and there was no rigid connection between the two. Neither of them could be adjusted very finely, and as a consequence, the drive was never satisfactory. The wheel on the line shaft broke several times and considerable delay and damage was the result, and even while the drive was running, it was noisy and vibratory. A pair of 1¾ in. pitch chains, 10in. wide, were substituted for the helical gears, and although the shafts were not quite parallel the drive is perfectly satisfactory, and has now been running for about 18 months.

Another example was that of some centrifugal pumps in the power station of the London Electric Railways at Lots Road, Chelsea. In this case the connected shafts were both vertical. Machine-cut helical gears and machine cut spur gears had both been used, but it was desired to replace them on account of the noise and vibration. A silent chain drive was put on, and horizontal guides provided to hold the chain up, and prevented it sagging between the wheels. The noise has been very much reduced, in fact, it is so slight as to be hardly possible to distinguish it from the hum of the motor. The power transmitted is 50 h.p.

It should be stated here that as a rule it is not possible to connect, by means of a chain, shafts that are vertical, being almost always necessary to provide some means of support for the chain between the wheels. Cases of this kind should therefore be approached with great caution.

Conclusions.

A good many of the examples given are subject to the comment that the belt, rope or spur transmission which was replaced was not a very good one, but the answer to this is that the vast majority of belt drives are not very good ones, and the power and money that is wasted on account of their use is incalculable.

Abstract of a paper read before the Rugby Engineering Society.

CHAIN REDUCTION GEARS.

A COMPARATIVELY recent application of chain drives is their use in connection with reducing gears and also in change speed boxes, examples of which are herewith illustrated. Both applications are patented by the Coventry Chain Co., Coventry, England, whose representatives in Canada are Messrs. John Millen & Son, Montreal. Fig. 1 shows a chain driven speed reduction box, with the top half of the case removed. These gears are regularly made in ratios up to 6 to 1 with single reduction, from 6 to 1 up to 20 to 1 with double reduction, from 21 to 1 up to 80 to 1, with triple reduction, and from 80 to 1 upwards with quadruple reduction. The pinions are of casehardened mild steel and the large gear wheels of cast iron, all being mounted on stiff shafts running on ball bearings. The whole gear is enclosed in a cast iron oil tight case, leakage at the bearing covers being prevented by suitable flexible washers.

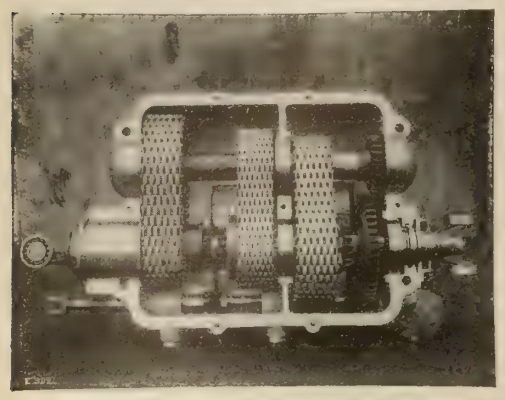


FIG. 3.—CHAIN REDUCTION GEARS.

This form of reduction gear has many advantages over those in which the gears mesh direct. It operates with much less noise, gives greater flexibility and perfect lubrication. It is especially applicable to heavy intermittent loads, such, for instance, as driving conveyor belts in grain elevators, etc. In such cases, the chains take up the sudden shock that would otherwise be transmitted direct to the gear teeth when suddenly starting up under a heavy load. Where the initial shocks are liable to be excessive, these reduction gears are often provided with special shock absorbing wheels.

Fig. 2. shows a Coventry chain-driven gear box applied to the reduction of the speed of an electric motor operating a cable haulage system. This illustration serves admirably to show the compactness of the arrangement. It is claimed that the useful life of the gear is considerably longer than that of similar gears using spur and worm gearing, and that the replacement of the chains is all that is generally necessary to make the gear equal to new, as the wheels and bearings will usually wear out several sets of chains.

Fig. 3. shows a chain-driven change speed gear box for automobiles, motor trucks or motor omnibuses. It was primarily designed to secure silence and resilience, but after considerable use is said to have proved more efficient and economical than those of the usual type.

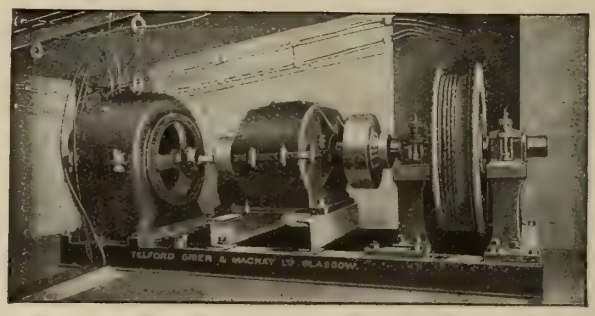


FIG. 2.—CHAIN REDUCTION GEARS.

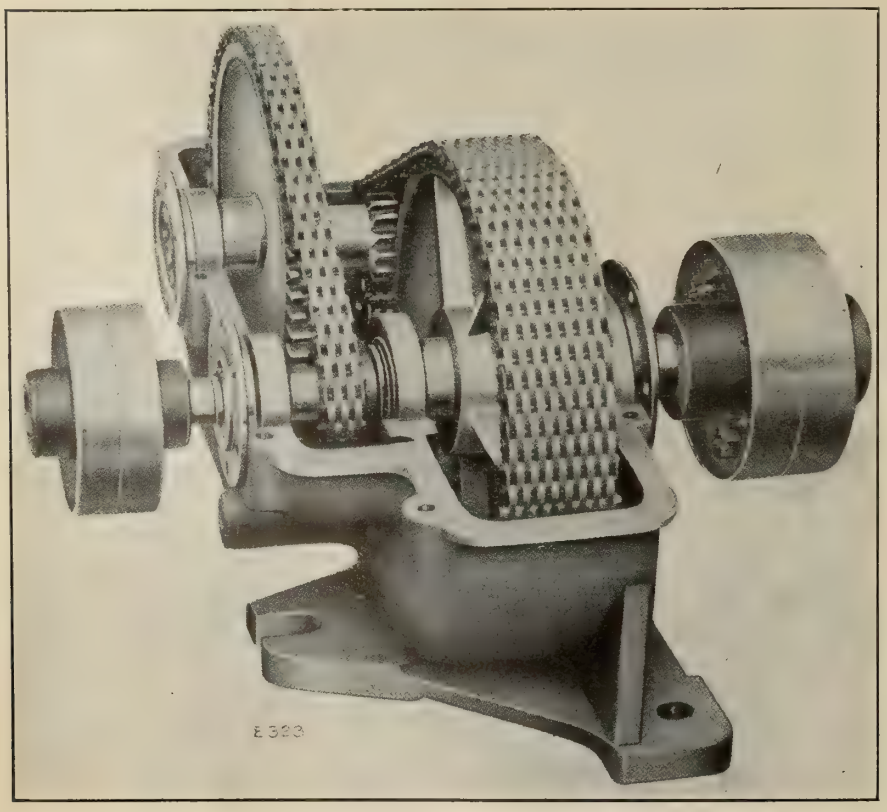


FIG. 1.—CHAIN REDUCTION GEARS.

BARRIE, ONT., LIGHTING PLANT.

WITH a profit of nearly $5,000, or approximately twenty per cent. of the total earnings, the Barrie Electric Light Commission has established a new record in economical management of a municipal owned public utility in Ontario. The following is a statement, as given to the auditor for final revision:

Expenditure.

Carbons	$ 3.60
Expense	1,323.77
Fuel	8,819.76
Interest on debentures	2,394.85
Debentures retired	3,202.08
Insurance	158.56
Boiler inspection and insurance	26.00
Oil and waste	278.55
Salaries	3,758.92
Wages	761.90
Balance	17,218.10
Total	$37,946.09

Receipts.

Balance 1911	$12,219.85
Light earnings (meters)	18,801.88
"	1,551.98
"	2,387.50
"	.75
Power earnings	2,215.30
Fines—discount lost by slow payment	376.35
Discount and interest	31.42
Profit and supplies	361.06
Total	$37,946.09

The Belt Drive as a Factor in Power Transmission Work*

By R. Berry

That the Belt Drive occupies a leading place, and does not apparently lose much ground through the introduction of other mediums for the transmission of power, is quite apparent to those who labor in factories, and to those whose business gives opportunity of becoming familiar with conditions in manufacturing plants of widely varying product. The very fact of their large and universal adoption makes necessary that those responsible be thoroughly conversant with their arrangement, care, treatment and capacity.

IN dealing with transmission of power by belting, I wish to include leather, canvas, rope, gut-cord, and steel band drives, giving as far as possible the merits and demerits of each method.

Inaccurate Standard Tables.

A pamphlet compiled by a gentleman who is credited with being an authority on the subject, gives a table to show that the output of a belt solely depends on diameter of the pulley on which the belt is running, and that velocity does not count. It is unfortunate that such tables get into print, and more so, as other writers, because he is credited with being an authority, have copied this same table into their books. I have several well-known authors' books containing the same misleading tables. It is quite evident that the compiler never tested it in a practical manner, or he would have discovered his mistake. However, such tables should be obtained by practical experience.

The table says that a 1 inch single leather belt, running upon 6 inch pulleys at a belt velocity of 6,400 ft. per minute, will just transmit 1 h.p. of work. Let us see how far this holds good. In the first place, providing pulleys are not very small, say, not less than 6 inches, from my own experience, the diameter has little to do with output, which depends on velocity and co-efficient of friction. Assuming there are no other losses, such as centrifugal force, etc., a 1 inch single leather belt at a velocity of 6,400 feet per minute would safely transmit 9 h.p., which is a vast difference from what the table shows. Under these conditions, the working tension per inch width equals 46 lbs., which is not by any means excessive.

Material for Belt Drives.

An engineer is frequently asked what kind of belt material he would recommend for a certain class of work. To determine which is the most suitable, leather, cotton, canvas, or rope drive, a proper knowledge of the surroundings is necessary. The first thing is to ascertain the atmospheric conditions where the drive is intended to be. In a very heavily saturated atmosphere, such as steam or damp, leather is positively useless, because water dropping on the working face of such a belt will cause instant slipping if it is working at anything like its full capacity.

On the other hand, moisture on cotton, canvas, or even rope drives may prove beneficial. I have seen canvas, cotton and rope drives working right out in the open and during slight rainfalls. Leather in such weather would not keep to the pulley many minutes, even under half-load. For moist atmospheres or outdoor work, cotton, canvas, or rope is preferable, but in warm, dry atmospheres (indoor, of course), good leather is far superior to either cotton, canvas, or rope. Canvas and cotton belts, if working in a very warm, dry shop, soon acquire a glossy surface and the pulley face becomes bright, which is a sure sign of slipping and loss of power. Again, leather, if properly cared for and treated with suitable dressing, may run for years with but little trouble.

Care of Belts.

The attention that belts usually receive, largely depends on the class of work. If at a soap works, they may get an occasional rub with a bar of soap, or in a printer's works a few dabs of printer's ink, and if in a cabinet maker's shop a swipe with a glue brush. In a drysalter's works a lump of dry resin is thrown in between pulley and band, and is immediately crushed, part of it sticking to the band and the other part distributed along the whole length of band race. On the other hand, some men take quite a pride in their larger belts and brush them down every week end and also occasionally apply a suitable dressing; one went so far as to scrub his main belts and give them a dressing of castor oil every holiday. Such care lengthens the life of the belt and improves its capacity for work.

Belt Sides.

We are fond of running belts with the soft or fleshy side nearest the pulley face, but in the United States you will see belts running with the smooth or hair side near the pulley. The hair side has a greater co-efficient of friction, and, consequently, better pulley grip than the fleshy side, although life of the belt will be somewhat shorter if so used. I favor the hair side being on the pulley, for better grip and improved efficiency. It is well known that practically all the strength of leather is in the hair side, it being possible to cut 40 per cent. of the flesh side away, without materially reducing the strength.

Iron bolts and copper rivets are best left out of any belt, because when passing over the pulley they reduce the grip considerably just at the moment, and if driving a dynamo or motor will cause a slight sparkling at commutator every time they pass. I always avoid belting that is stitched together with copper or other metal wire, although it is true that a belt stitched with wire is very strong, yet strength is not so important as adhesion. The properties of an efficient belt are:—Reasonable tensile strength, say, 3,000 lbs. per sq. in., high adhesive quality, free from elasticity, great flexibility, homogeneous throughout, and not greatly affected hygroscopically.

Power and Speed.

If troubled by a belt constantly slipping, even though tightened to the maximum tension, the bearings and shafting will stand without seriously heating up, it will not materially help matters to lengthen the distance between centres of shafts or to increase the width of belt or put on thicker material or double leather. None of these will be of service without a corresponding increase in tension, and that already is prohibited by the bearings. The only way of getting over the difficulty is to increase the velocity of the belt by larger diameter of pulleys or speeding up the shafting; this will obtain better results with a reduced tension upon the bearings and shafting.

I advocate keeping up the speed of belting, and there is good reason for doing so. A 10 inch single leather belt running at 70 ft. per minute under good conditions only transmits 1 h.p.; if speeded up to 5,000 ft. it would, for the same total tension, transmit 70 h.p. These are extreme cases, but any belt will stand a speed of 3,000 to 4,000 ft. Machine tool designers would do well to bear this in mind. You have heard the screeching or squealing made by the belt changing over from one pulley to the other on a planing machine at each

*From a paper read before the Birmingham Association of Mechanical Engineers.

reversal, and can readily conceive the shock and heavy torsional stresses the whole gear is subjected to and the heavy gulp of energy absorbed at each reversal.

With an electrical drive it is easy to measure this, and I have several readings which show at times more than treble the amount of energy absorbed at reversal than required for the heaviest cut. This is when the table is changing from cutting to return stroke, often at the rate of 140 ft. per minute. The average width of a planing machine belt is anything from 3 in. to 6 in., and often of double leather. On very large machines, I have known 8 in. double leather used. If it were possible (and I fail to see why it should not be) to increase the belt velocity three or four times, you would only require a belt quarter the width to perform the same work; in place of the 6 in. belt, a 1½ in. belt would do.

The output of any belt material varies directly as the velocity or speed. I can instance a very large planing machine driven with a 3 in. double leather belt, and the drive is very successful. The machine has a 24 ft. table, which weighs 19½ tons, and is capable of displacing, with four tools cutting, 11 cwt. of metal per hour—and all this with a 3 in. belt. Another planer, 6 ft. by 4 ft. by 4 ft. is driven by a 1¼ inch double leather belt, running at 5,000 ft. per minute (equivalent to a 6 in. belt running at 1,200 ft. per minute). This is far better than the old method of wide belts and comparatively slow speeds. The second machine has been running four years and has given little trouble. The narrow belt easily passes from one pulley to the other, and when doing so, is practically free from squealing.

Engine and Dynamo Speeds.

Fully twenty years ago I argued with engine builders and dynamo makers about keeping the speed of engines up and dynamo revolutions down, with a view to reducing the ratio in speed. At that time, low-speed dynamos were unheard of; the general run of either dynamo or motor would be (for machines up to 10 h.p.) 1,200 to 1,800 r.p.m., and in exceptional cases as high as 2,500 revolutions, while only generating a comparatively low voltage of 50 to 60 volts. The much larger dynamos would be running at 700 to 900 revolutions, but rarely below 700, and in almost every case driven from the fly wheel of the engine, generally of the slow-speed type; so that it was common to see a large ratio in diameters between driver and driven pulleys, frequently 6 or 8 to 1, with the result that any slight fluctuation on the engine would be multiplied on the dynamo causing a constant flicker throughout the lighting circuit.

To remedy this defect, several electrical and mechanical contrivances were devised. Engine builders began to increase the weight of fly wheels, and on gas engines, frequently, two fairly heavy wheels were fitted, one on either side of the engine.

The Largest Belt.

The Chicago Belting Co. have made a monster belt; length 150 ft., width, 7 ft., weight, 3,300 lbs., thickness ⅞ in. Selected portions of 450 oak-tanned hides, picked from over 5,000 skins, were used in its construction. It is used in the engine room of the Louisiana Electric Light Co., at New Orleans, attached to the 28 ft. driving wheel of an Allis-Corliss engine. It is generally believed that this belt is the largest ever made.

Tensile Strength.

The average tensile strength of ordinary leather belting equals 3,000 lbs. per sq. in., that of rope being about 20 per cent. higher. I do not attach much importance to this, because the breaking strain of any belt material ought to be quite a secondary consideration, as the working tension is always a small fraction of the breaking strain. A belt of high tension strength, but with a correspondingly low co-efficient, although very strong, will be a poor transmitter of energy.

In the early days when power-driven lathes were unknown, catgut bands were almost always employed for transmitting motion from the foot wheel. The great strength and long wearing qualities of catgut make it a material unapproached by any other for the purpose; yet, seemingly, with the advent of power-driven machinery, its value as belting material has largely been lost sight of.

As catgut will work efficiently under a tension of 2,700 lbs. per sq. in., or about five times that of leather, and for long periods, it is obvious the material is good for something else besides violin strings. Owing to the better co-efficient of gut cord in a grooved pulley, for certain machinery, it should prove more profitable than leather or other material. I remember a round gut cord band ⅜ in. diameter running at 5,000 ft. per min., and transmitting 40 h.p. on an eight hours' trial run, which would be equivalent to 3,000 lbs. per sq. in. for working tension. The objections to the use of gut belting is its heavy first cost, susceptibility to weather, and the difficulty of making a good and flexible joint.

Steel Belts.

We hear a great deal about steel belts running on rubber or cork-faced pulleys. Professor Kammerer, of Berlin, makes great claim for these, and shows some remarkably good results. I fail to see any great advantage in such high tensile material, and feel that the consequences might be very serious if a long steel belt, very much like a band saw, only considerably wider, longer and heavier, should break. Just imagine about 200 ft. of this steel snapping and becoming entangled with the revolving machinery, coiled up and being swerved round at a velocity of two miles per minute. On one of his illustrations he shows two steel belts, 150 mm. wide, 0.7 mm. thick, transmitting 450 h.p., replacing twelve hemp ropes. A good steel may have a tensile strength of twenty times ordinary leather, and a steel belt 1 in. wide would do the work of a single leather belt 20 in. wide, and, assuming it does, I cannot see any real advantage.

In the first place, if one material is twenty times stronger than another we increase our working tension by the same ratio; the factor of safety is practically the same, and pressure per sq. in. of surface made by the steel belt on rubber-faced pulley must be enormous, and one that would soon cut a deep furrow in the composition. Again, a steel band running on a rubber-faced pulley cannot possess a better co-efficient of friction than a rubber or cork-faced belt runing on an iron-faced pulley, so that the only real advantage is that the space occupied is narrower, also pulley faces. He shows belts traveling at 10,000 ft. per min. and for pulleys, however carefully balanced, that is a dangerous speed.

Stretching and Creeping of Belts.

It is usual to assume that the number of revolutions of two shafts connected by a band is inversely as the diameters of both driver and driven pulleys, and for most purposes it is perhaps safe to accept it as such, although, strictly speaking, it is not quite true, because when a belt is doing work, the tight or working side will be constantly stretching considerably more than the slack side, the amount depending upon the elastic properties of the material in the belt and the working tension on it. Consequently, the pulley and shaft which are being driven will fall behind in speed by an amount equal to the excess of extension. For instance, it has been shown that by using a very elastic belt the driven shaft was only running about half-speed of the driving shaft, although both pulleys were practically the same diameter. The creeping effect which is constantly going on will also tend to increase this lagging behind of the driven pulley, which is also increased by the longer distance between pulleys, although there may not be any slipping, in the real sense of the word.

The creeping effects of belts is often spoken of as being a legitimate effect of lagging behind, which is an actual loss of power, and one that unfortunately cannot be avoided, either by means of belt tighteners, belt compounds or solutions, or patent pulley coverings. It is due to the band undergoing compression and tension every time is passes over the pulleys, and cannot be prevented by tightening up the belt; therefore it does not represent the usual slip with slack belts. With good material, the creep should not exceed 1 per cent., whilst the slip due to unequal stretching between tight and slack sides of belt should not exceed 1½ per cent. Therefore the total lagging effects upon a property designed belt drive should not be more than 2 to 2½ per cent.

Double Leather Belting.

Avoid double leather belts as much as possible, especially where the pulleys are small in diameter. The chief reason for using these is to cover up some poor design of machinery, where it is found necessary to employ a heavy tension per inch in width in order to get the belt to fulfil its requirements. This heavy tension will sooner or later tell its tale upon bearings, shafting and loose pulleys. If a belt gives trouble by constantly slipping, better by far increase the velocity by increasing diameter of both pulleys, if possible, for by doubling the velocity, the belt will give a double output in energy transmitted, without the slightest increase of pressure upon bearings.

The weight of a belt should be as little as possible, consistent with the power to be transmitted; this not only saves power in keeping the belt itself in motion, but reduces the centrifugal action that tends to keep the belt from coming into proper contact with the pulley face, especially at very high speeds. When a double leather belt is passing round a small pulley at very high speed, the belting is pulled away from the pulley face several degrees, due to the inflexibility of the belt, and if the arc of contact is as important as we are led to believe, then discourage the use of double leather or any other heavy, thick belt material.

It is not always possible or convenient to obtain a high velocity of belt speed without practically re-designing the machine, and often machine makers put on pulleys far too narrow and too small in diameter, to allow of a suitable belt being fitted. In such cases, there is no help for it but to put on a double belt, or even compound it by putting on a second belt the same width, to ride on top of the original one. Either case puts an excessive tension on the bearings. If both pulleys are large in diameter, say 4 ft. or 5 ft,. there is not much harm in using double belting.

Convexity of Pulleys.

Engineers are generally agreed that pulley faces should be rounded, but to what extent, they do not agree. It is no uncommon thing to see a band running on two pulleys with a wide difference of roundness, which is very injurious to the band, especially where dry resin is freely used. Diameter should not have any relation to convexity, this being solely controlled by the width of face. In order to adopt some universal method, I suggest:—

Square the width of face in inches, and add 10 to the result, and take this as the radius for striking the arc of convexity, from which sheet steel gauges could be struck, made and kept by for use. As example, take a pulley with a 6 in. face, then $6 \times 6 + 10 = 46$. This should be the radius for striking the arc. Or, again, a pulley 4 in. face — $4 \times 4 + 10 = 26$ in. radius. This method I have used for many years, and proved it satisfactory for any width of pulley.

Arc of Contact.

There is no doubt that as you increase the arc of contact, embraced by real direct tension, you must obviously increase the gripping power of the belt, but to increase the arc of contact by idlers, jockey pulleys, or having slack side of belt on top, I consider to be a very poor way of obtaining one's object. It has always been a mystery to me why engineers should put down slow revolving engines or main shafting to drive high-speed machines, then, owing to the great ratio between two pulleys, resort to idlers or jockey pulleys, placing them near the smallest pulley for the purpose of increasing the arc of contact.

If the machines to be driven are of necessity high speed, speed up the driving shaft or put down high-speed engines, gas, oil, steam or even steam turbines, and either couple up direct, or, if it must be belt drive, design to have pulleys of equal diameter or thereabouts, but certainly not more than 4 to 1 ratio. In the case of dynamo driving, it is possible to obtain low speed dynamos and high-speed engines which will give pulleys, both driver and driven, the same diameter, then with such, you obtain the very maximum arc of contact possible for a straight belt without jockey pulleys or idlers.

Long Drives.

You cannot hope to materially increase the working capacity of a belt otherwise than by velocity, improving the adhesive effects, or increasing total tension, but it matters little whether total tension is increased by actually tightening the belt or produced by the sagging of the long heavy belt. In many cases the engineer in charge, for the sole purpose of obtaining long drives, has a machine at one side of the shop and countershaft at the other, taking the first belt from line shafting across the whole width of shop to countershaft, and then a second belt again across the shop to machine, which, to say the least, is overdoing the thing, in addition to the waste of belt material.

I am not advocating very short drives with narrow and excessively tight belts. I recommend keeping the belt velocity fairly high, say, up to 4,000 ft. per minute where possible, and so reduce both width and weight of belt, and give shaft and bearings the chance to live a long life without making a lot of trouble. Take total circumference of both pulleys to represent distance between centres of shaft, whatever the diameter of pulleys may be. Such distances, to my mind, give sufficient flexibility and room to turn in without waste of belt material.

Mr. Halliday, in his book on "Belt Driving," says:

"Of all the ways by which a belt may be made to drive more, giving it great tension may be regarded as the poorest all round. Give it more arc of contact, give it better pulley surface, increase the width and thickness, which will increase the output; do almost anything except to increase the tension." He says "do anything but increase the tension," and at the same time put on a thicker and wider belt. What for? What are the virtues of double leather? The grip of a double leather belt is no better than that of a single one, unless the tension is increased either by the heavier belt or by tightners, or other means. The effect on life of shafting, bearings and loose pulleys will be the same whether the increased tension is due to a heavier belt or tightness.

My advice is:—Don't use double leather in any case where it can possibly be avoided. There is no reason for doing so, except to employ a greater tension on the pulley face and between the two shafts, which tends to considerably reduce the life of shaftings, bearings and pulleys.

Belt Grip.

The grip of belt is quite independent of the area of contact and it is also immaterial whether the surface is flat or curved, so long as it is uniformly curved, such as a pulley face. To test the gripping power of a belt, or, in other words, the co-efficient of friction, for any material used for belt-making, in its true working position, on a curved surface, simple experiments can be made:—

(1) Select a pulley, say, 12 inches in dia., properly turned and finished, and fixed; throw the length of belt over the pulley, allowing the ends to equally hang. To each end suspend a weight;

then to one end add additional small weights until the belt just begins to show signs of slipping. Divide the weight of the additional weights by the total weight upon the belt at the time it began to slip, and the quotient will be the value of the coefficient of friction for the material under test. Say we hang a 56 lb. weight to each end of the belt, and then additional weights on one end until it began to slip, the additional weight being 60 lbs., then the co-efficient of friction for the belt material under test would be $60 + 56 + 56 = 172$. $60 \div 172 = 0.3488$ = co-efficient of friction.

(2) Now select a second pulley, say, 10 inches in dia., place the belt as before, hang on to each end of the belt the 56 lb. weights, and then add the additional 60 lb. weight upon the one side, when it will be seen that the belt will commence to slip, as it did in the previous test. Although the surface embraced is ten times larger than when on the 12 inch pulley, yet the gripping power of the belt is not improved.

(3) A third experiment will be to take a belt made of the same material, but ten times wider, and place it over a suitable pulley with a sufficient width of face, and any diameter, and hang on the two weights as before, when it will be seen that the same additional 60 lb. weight added to one side will cause the belt to slip, in spite of the fact that the belt is ten times wider than the previous one. This will prove that the grip of a belt is precisely the same for the same total tension, whether it be a narrow belt or a wide one, or whether the pulley be large or small in diameter. In these experiments it is essential that both belt material and pulleys should be new; if not, care should be taken to remove any sticky solution from the pulley face and belting, otherwise, in comparing a narrow belt against a heavy one, the operator will arrive at an erroneous conclusion, as a belt property cared for by applying considerable dressing (not a sticky solution) will have a much better co-efficient of friction than a belt which has been neglected and allowed to run dry. Also, in order to be correct, the weight of the belt material under test should be added to the total weight in each case, when dividing into the added weight for the co-efficient of friction.

(4) As a fourth experiment, take a case in which there is a pulley fixed to a shaft, free to rotate, with a length of belting hanging over the pulley, and to each end of the belt suspend a spring balance, which is in turn fastened to the floor by adjustable screws for varying the tension on the pulley face. Screw up the tension screws until each balance shows a reading of say, 50 lb., or a total of 100 lb. on the pulley face, which is known as the initial tension; then set the shaft in motion, and let it rotate very slowly. Whilst the shaft is running, take the readings of each balance. This is a very important experiment, for it forms the key to the whole system of transmission of power by belts. The different tensions or readings of the two balances when the shaft is in motion depend upon the co-efficient of friction for the material under test. It will be seen that the sum of strains on the two sides of the belt is always equal to the initial tension. This difference in tension is intended to represent the driving force or working tension of a belt in motion, and, if multiplied by the velocity of belt in feet per minute will give the ratio of doing work in foot-pounds per minute.

In introducing these experiments it will be seen that a wide belt does not grip the pulley face any better than a narrow one with the same tension, which will be found correct; but it must not be imagined that I am prejudiced in any way against the employment of wide belts, for that would be absurd. It must appeal to any sane person that if the working tension is to be a heavy one, obviously the belt must be wide enough to carry this heavy tension.

The Berry Method.

After a new machine (electrical or mechanical) has been fixed, the greatest difficulty is to determine the proper width in order to transmit just sufficient energy to obtain the maximum rated output from it with minimum initial tension on both shafting and bearings consistent with highest efficiency. The only guide that the non-technical man has in deciding this, is the width across the face of the pulley usually supplied with the machine, then, if the pulley supplied is rather wider than necessary, the employer will be put to the extra expense of buying an unnecessarily wide band, owing to the man's inadequate knowledge of belt tensions or of belt capacity generally. On the other hand, should the pulley be too narrow or too small in diameter for the full or rated amount of work, the man whose duty it is to attend to the banding will be continually called upon to either use some band solution or tighten up the band every time machine is being worked up to its rated output.

To be continually tightening up the belt means courting mishap and further trouble, because there is a limit to the tension which belting will stand, and having reached that limit, it breaks and causes a complete stoppage, which may be rather serious. Another point to be considered with running belts which have been tightened to an excessive pitch, is the life of bearings, shafting, and loose pulleys. It stands to reason that where excessive tensions are employed the life of all wearing parts must be considerably shortened.

Rule For Belt Calculations.

After years of experience with belt drives and engineering generally, I find that a good all-round and easily-remembered rule for belt calculations is that 1 ft. per minute of belt speed per inch width of belt is safely equal to transmitting one watt of electrical energy, so that, if we multiply the band speed in feet per minute by the width in inches, the result will be total energy in watts or, dividing by 1,000, kilowatts that the band can safely be relied on to transmit, without undue tension being brought on any part of the band, or excessive friction on any part of the machinery. These data only apply to single leather belting or woven belt of equal thickness. If a light double leather band be employed, then 25 per cent. more energy may be calculated upon, or for heavy double leather as much as 60 per cent. may be added.

The great advantage in this method or rule is that it fixes a constant for working tensions, so that the working tension becomes directly proportioned to the width in inches, this constant being 44.24 lb. pull per inch width of belt.

If it is required to know the difference in pounds pull on the tight and slack side of any belt, divide the total output of machine measured in watts by velocity of belt in feet per minute and multiply results by 44.24; the product will be the extra pull in pounds of the tight side over the slack. It also conveys some idea to the average man, when he is deciding upon a belt, as to what amount of stress is likely to be brought upon it when being worked up to the maximum load, thus obviating trouble from belts being either worked excessively tight or ridiculously slack.

Rope Drives.

Of all the systems by which motion may be transmitted from one shaft to another, especially where general lineability and parallelism is not possible, the method of transmission by means of rope drives figures well up the list. Extreme lightness, easy yet noiseless running, together with practical immunity from serious breakdowns, make it preferable to any other system of gearing or heavy flat belt drives.

In the application of rope driving, the average speed of ropes is about 4,500 ft. per minute for main drives. Exceptional cases have been met with of ropes running at 7,000 ft. per minute, and in one instance I remember a main drive of ropes running at 8,500 ft. per minute, which is excessively high, and not to be recommended. The average speed for intermediate driving varies between 1,500 and 3,000 ft. per minute.

Transmission of Large Powers by Silent Chain

By W. E. Meadwell

This article features the accomplishment of highly satisfactory results from the operation of silent chain drives, and it will be noted that the service being performed is such as to test to the fullest extent the qualities and capacity of any type of transmission.

MANY engineers who have been wont to specify only belt-drive or gearing of which they knew the efficiency, durability, etc., for service entailing quick stops and starts, variable motor speeds, jerking between centres, etc., will undoubtedly be interested to know that there is one type of silent chain which has been performing just such and probably more severe service for some years.

Figure 1 shows a rubber mill or mixer which, with others on the same shaft, is driven by a Westinghouse 200 horse-power constant speed induction motor. The double chain of this particular mill is of the Morse silent "rocker joint" type, 10in. wide, 1½in. pitch, with a speed of 1,250 feet per minute at the highest motor speed. The sprockets, of 23 and 117 teeth, with speeds of 435 to 85 r.p.m., are set at 84-inch centres.

The drive on these machines is subjected to very severe service from the uneven load, due to the rubber being run through the rolls in bunches or lumps, yet it has given more satisfactory service than gearing, which has always heretofore been used on this type of machine.

Fig. 2 shows a 150 horse-power Morse silent chain driving another mill line in the same plant, the motor being placed outside the mill room. The chain is 15 inches wide, 1½ inches pitch, and the sprockets are set at 84-inch centres. The motor is of Westinghouse constant speed induction type.

Fig. 3 shows, in the foreground, one of a battery of four-roll rubber calenders, each driven by a 75 horse-power Morse silent chain from a Westinghouse A.C. four-speed induction motor. The chain is 1.2 inches pitch by 9 inches wide, sprockets of 21 and 105 teeth, with speeds of 690 to 138 r.p.m. being set at 54-inch centres.

Fig. 4 shows a three-roll calender driven by a 50 horse-power Morse silent chain from a Westinghouse motor. This chain is 1.2 inches pitch, 6 inches wide, with a maximum speed of 1,450 feet per minute. The sprockets are of the same number of teeth and speeds as for the four-roll calenders noted above. These calenders are for making friction cloth and rolling out sheet rubber. The load is more even than on the mills or mixers, yet there are frequent stoppings, changes from one speed to another, etc.

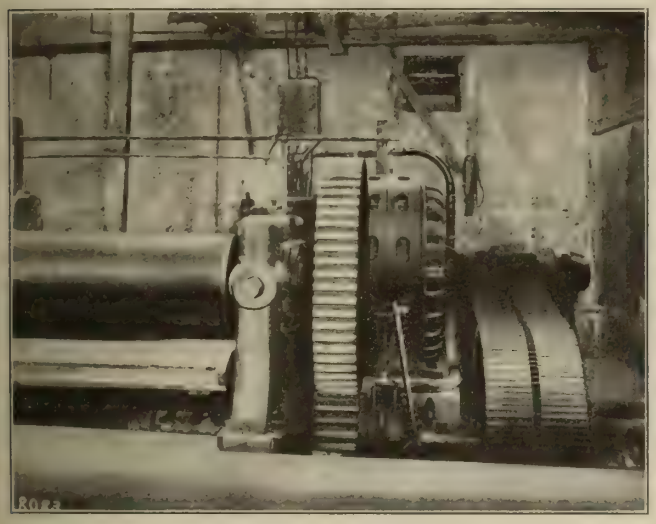


FIG. 1. SILENT CHAIN TRANSMISSION OF LARGE POWERS.

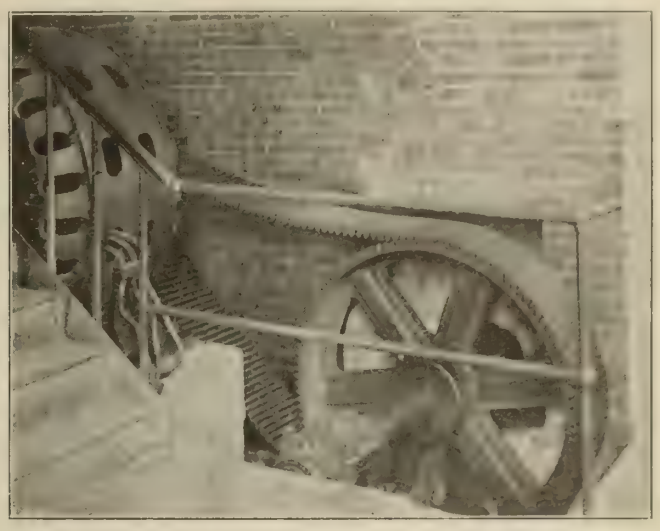


FIG. 2. SILENT CHAIN TRANSMISSION OF LARGE POWERS.

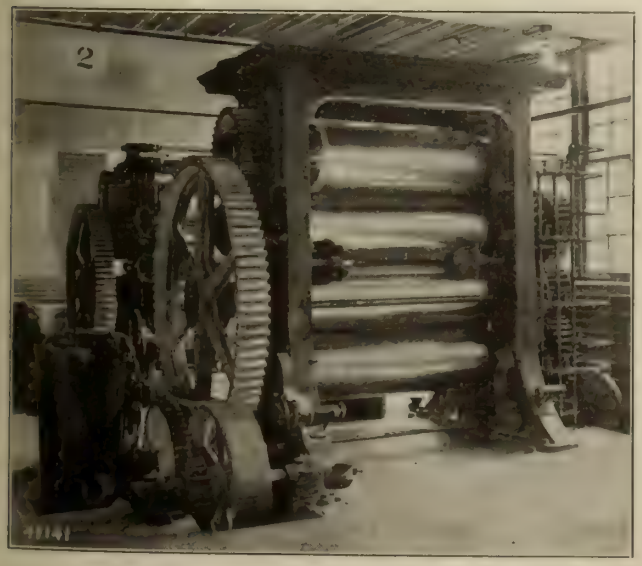


FIG. 3. SILENT CHAIN TRANSMISSION OF LARGE POWERS.

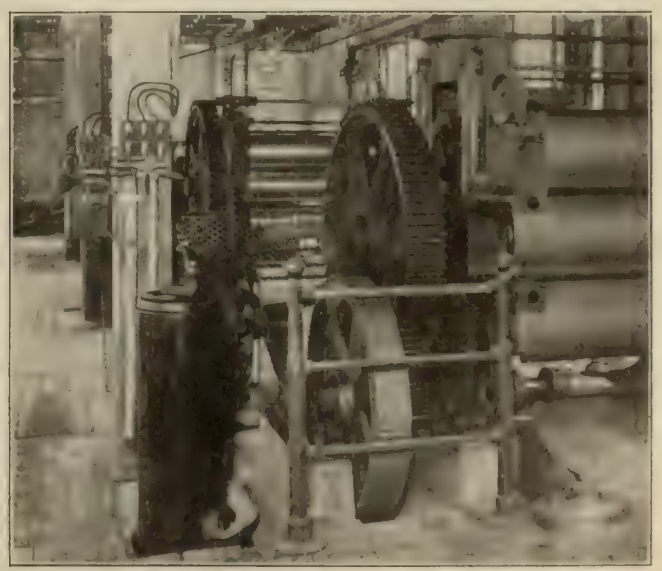


FIG. 4. SILENT CHAIN TRANSMISSION OF LARGE POWERS.

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THE PURPOSE OF TECHNICAL SCHOOLS.

IN some recent issues of The Power House the question of Technical Education and the subject of Technical Schools as mediums for its acquirement were discussed. Evidences are not lacking that there is a growing disposition to lose sight of the education feature and to glorify the institution. Little thought is given to the personnel of those who will enroll as students, to their wants and to their expectations, a circumstance which forcibly indicates not a misconception but a lamentable ignorance of the A.B.C. of the technical education movement and purpose. Here, in Toronto, attempt is being made to foist upon the inhabitants a two-million dollar or more technical institution, by a body of men whose knowledge of actual requirements is conspicuously lacking. The erection of a palatial building, equipped with the most modern tools, appliances and equipment will fail to attract those whom the technical education movement is designed primarily to help.

Mechanics, generally, are somewhat sensitive in the matter of arrangements made, presumably for their welfare, and are inclined to feel as much at ease in a magnificent educative building, as most of us would feel were we invited to enjoy a pipe with King George V. at Buckingham Palace. We have universities in leading centres of the Dominion, where those who can meet the price may be instructed and trained for trade and professional work, and there is neither need nor reason for going into open competition with these. What our mechanics and operators want, and what they should make demand to get, is a number of modest, well equipped schools located centrally in manufacturing districts to which they may come in the evening, and from which they may go away with an addition to their stock-in-trade.

The distinction in architecture should be the least possible from that evidenced in a well-designed and laid-out factory, and in addition it should be the aim to have the internal arrangements and conditions correspond also to the fullest extent possible. Nobody cares whether the pie dish is of granite ware or earthenware; we are all more interested in the pie itself, and the latter, in this instance, consists of the instruction to be obtained. Aside from the question of magnificence, the staff more than the equipment or even the structure is the all-important consideration. Its personnel, to be of the highest value, should consist of men whose upbringing and training has fitted them to appreciate the needs of the individual student; in a word, such as will make the instruction the most useful, practical and effective in securing advancement for the recipient.

We must say again that there is too keen a disposition being displayed to erect and equip an institution which will surpass everything in sight of a like nature, and the circumstance is lost sight of that "every dog has its day," likewise every top-notcher technical school, and that tomorrow some one-horse town will get the craze and take first place. We talk about the mad rush among the nations of the world to increase armaments, but who shall deny that there is more of necessity and wisdom in the latter than belongs to technical school buildings and equipment. It should not be necessary that twentieth century mechanics have to accept bricks and mortar in lieu of instruction, and our manufacturers will not only be serving their own interests, but that of our communities as well, when they set their faces steadfastly against every attempt in the direction indicated of every heterogeneous body of men on whom a little passing authority has had the effect of unbalancing the seemingly ill-assorted modicum of intelligence they were privileged to possess.

ELECTRICITY AND HYDRAULICS

This department is intended, in addition to individual treatment, to feature the close relationship existing between electricity and hydraulics in the power and light field.

TESTS OF LARGE VOLTAGE OIL CIRCUIT BREAKERS.

SOME tests on large voltage oil circuit breakers were recently carried out at the plant of the Hydraulic Power Co., Niagara Falls. The tests showed that a circuit breaker should have an operating mechanism giving quick and positive action. Breaks as quick as 0.09 secs. have been obtained, the usual time varying between 0.3 and 0.6 sec., depending on the method of tripping and the type of circuit breaker and instantaneous relay. The voltage disturbance increases with the speed of operation, the phenomena depending on the nature of the load carried by the generator. A long time element limits the shock to the circuit breaker when opening circuits with large power and low impedance, but allows a considerable drop in voltage and extensive destruction at the point of short circuit. It is impracticable and undesirable to interrupt a short circuit during the first cycle when the current is at a maximum. The shock to the generator is not eliminated by any practicable speed of working. The effects of action and reaction at the moment of breaking were also considered, but the results showed that perfectly satisfactory apparatus can be used on large power systems, even when the operating conditions are very severe.

OXIDE OF ALUMINUM INSULATION

THE oxide which forms on aluminum is a good insulator, as is shown by the fact that field coils for tramway motors are being made up of bare aluminum wire. For this purpose the wire has a specially thick layer of oxide deposited on it by treatment with borax. The bath contains 50 parts alcohol, 60 parts of ammonia and 100 parts of water saturated with borax, and the temperature is kept at 50 to 80 deg. Cent., whilst a current of 0.05 amperes per square cm. surface of the coil is passed for about 15 minutes. After being washed and dried, the completed coil is taped round in the usual way, and it is of interest to note that the actual cross-section of the finished coil is no larger than a coil made of copper wire, although there are the same number of turns. One reason is that aluminum can be worked at a higher current density, and being a solid mass of metal, the heat gets away more readily. The temperature co-efficient is about 10 per cent. less than for copper.

WHAT DO YOU PAY FOR WATER?

ON the average each person in Canada served by waterworks uses 113 Imperial gallons of water a day and pays $4.12 a year for it, according to a report on the waterworks of Canada in preparation by the Commission of Conservation.

New Brunswick has the highest per capita consumption in Canada, viz: 161 gallons per head per day, while Manitoba and Saskatchewan have the lowest—46 gallons per head per day. The more general use of meters in the Western provinces reduces waste and keeps the per capita consumption down to about the same amount as in European countries. The people of Manitoba pay the highest per capita rate for their water—$6.27 per year, while those of New Brunswick come next with a per capita cost per year of $4.82.

The following table shows the estimated cost per 1,000 gallons, the estimated cost per capita, and the daily consumption per capita:

Province.	Estimated Cost per 1,000 gal. (cents)	Estimated Cost per Capita per year (dollars)	Daily Consumption per Capita (Imp gal)
Nova Scotia	7	3.76	147
Pr. Edward Is.	16.4	2.87	48
N. Brunswick	8.2	4.82	161
Quebec	9.5	3.92	113
Ontario	9.6	4.21	120
Manitoba	20.6	3.46	46
Saskatchewan	23.0	3.86	46
Alberta	13.0	6.27	132
British Columbia	8.2	3.44	115
Canada	10	4.12	113

THE COST OF WATER EXPERTS.

THE sum of $15,798.41 represents the bill rendered to the city of Edmonton by Messrs. Francis, Ross and Lee, board of consulting engineers, who have reported on the Edmonton water supply. This does not include their report on the electrical distribution system. The bill rendered is itemized as follows:

To professional services to date of the board of engineers of Edmonton, Messrs. Walter J. Francis, R.A. Ross and R. S. Lea, in connection with water supply and other problems, exclusive of electrical distribution systems.

June, 1912—To time of the board in connection with preliminary investigation of the water supply, conferences with civic officials at Edmonton, discussions of matters pertaining to data and visits to various sources of supply at $100 per day for each member of the board, $3,550.

June 25, 1912, to Feb. 20, 1913—To time of the board subsequent to preliminary investigation, in connection with circulation water problems, tunnel problems, study and report regarding pump tenders, study and report regarding general water supply, at $75 per day for each member of the board, $7,086.25.

June, 1912, to date—To expenses paid for transportation, hotel accommodation, photography, telegrams and miscellaneous, $748.66.

June, 1912, to date—To time of staffs engaged in detail work, draftsmen, clerks and stenographers, $4,413.50.

NEW MOTOR STARTING DEVICE.

SMALL pump motors, etc., are sometimes connected in series with a resistance permitting a current rush on starting of about four times the full load current. The resistance remains permanently in circuit and the motor horse-power is reduced about 20 per cent. A German firm, however, has recently devised an arrangement which consists of an iron wire spiral mounted in a hydrogen-filled bulb fitted with an Edison screwed socket. For a 2 horse-power 220-volt motor, the resistance is 2.4 ohms cold and attains a maximum value of 26 ohms after about 0.8 seconds. On a 110-volt circuit, the cold resistance corresponds to a starting current of 46 amperes, but, owing to the small heat

capacity of the wire, it is impossible to obtain a higher starting current than 31 amperes. As the motor gains speed, the resistance is automatically short-circuited. The motor then develops full speed and output.

In direct-current circuits the device is connected in series with a small constant resistance, but this is unnecessary in three-phase circuits. In direct-current circuits the device is designed for half the line voltage. Two sizes are made, 330 and 500 watts respectively. Automatic direct-current starters of this kind are made up to 8 horse-power capacity. In small starters, the starting relay controls the short-circuiting of resistance in accordance with the armature voltage, but in larger units the resistance is short-circuited in sections at fixed time intervals.

INTERPOLE INVERTED ROTARY CONVERTER.

THE "Electrician gives a brief account of an interpole inverted rotary converter with special characteristics, which make it adaptable for use in laboratories. The machine will generate single-phase or three-phase current at a frequency of 60, or it may be operated as a shunt wound or compound wound direct-current motor of the commutating pole type. In order to make it flexible for testing purposes, the machine is equipped with a compound winding, so that it may also be operated as a compound wound direct-current generator. When operating as a direct-current generator at a speed of approximately 2200 revolutions per minute, the machine is flat-compounded from no load to 50 per cent. overload.

It is equipped with commutating poles and has shaft extensions on both ends in order that arrangements may be made for its operation either as a direct-current motor or a belt-driven generator. When the machine is brought up to speed from the direct-current end, it can be synchronised with a three-phase line to operate as an alternating-current motor or as a rotary converter.

HYDRAULIC TRANSMISSION TRUCK HAULS 45-TON LOAD.

ANOTHER remarkable trailer haul was recently made by the LaFrance hydraulic truck. A frame for the door of the new vaults which are being put in the bank clearing house of New York city had to be moved through the streets. This frame, made by the York Safe & Lock Co., was brought to New York on a lighter, and delivered at pier 11, East River. A four-wheel wagon, which, when empty, weighed 16,400 pounds, was requisitioned to carry the frame. The latter was 7ft. 6in. wide, 9ft. long and 3ft. 6in. thick, and weighed exactly 52,600 pounds. The LaFrance Hydraulic truck was itself loaded with five steel plates for this vault, which in the aggregate weighed 12,100 pounds. The truck weighed 4½ tons, so that the total load to be moved was 90,100 pounds.

The shortest way to deliver this load to its destination would have been through Wall Street, but permission to use this was denied on the ground that the street paving would not support the load. The truck had, therefore, to proceed down Front Street to South Ferry, and then up Whitehall Street to Bowling Green, and up Broadway to Cedar Street. Two horses were hitched to the pole of the truck so as to control this and allow the trailer to be steered right. A grade of 4½ per cent. was encountered on Broadway at Bowling Green, just above Beaver Street. The frame was placed upon timbers mounted on the truck, but the load was so great that it crushed the timbers, so that a stoppage had to be made and the frame jacked up and new timbers placed underneath. The only street damage done was the breaking of one small manhole on Whitehall Street.

In order to show its remarkable tractive effort, the truck was stopped with its load on the 4½ per cent. grade at Bowling Green, and had no difficulty in starting again. The draw bar pull required to start this load and keep it moving on this hill was a little over 9,000 pounds. This demonstration illustrated very forcibly the fact that because of the hydraulic transmission this truck is capable of exerting a tremendous draw bar pull at starting and at low speeds. The speed at which the load was hauled was four miles per hour, and it would have taken at least 20 horses to do the job, going at not over 2½ miles an hour at most. The fact that the load was moved at four miles an hour instead of 2½ obviated the breaking of a large number of manhole covers and prevented damage to the road. The load was so heavy that after the automobile had delivered the truck and frame to its destination the very weight of the equipment standing still made the wheels cut into the asphalt, although moving along the road it made no impression. The Hydraulic Truck Sales Co., Broadway, New York, are distributors of this truck, and to them we are indebted for the photo and data.

WHAT A FIRE CHIEF ADVISES.

Fire Chief Davis, Victoria, B.C., says:

Stop the practice of tying electric drop wires by string or wire, and disallow paper shades to be placed around the bulbs.

At the closing hour, all windows should be closed, and all electric lights shut off except in hallways or stairways.

Place no inflammable material, paper, cardboard, cloth, wood, etc., near steam radiators or pipes.

Do not throw ashes of cigar or pipe, or the unburnt match, into the waste paper basket.

HYDRAULIC TRANSMISSION TRUCK HAULS 45-TON LOAD.

REFRIGERATION DEPARTMENT

MECHANICAL REFRIGERATION. II.*

By William M. McRobert.**

THERE are so many makes of ammonia compressors that it is impossible to specify any particular type, but anyone who is acquainted with the ordinary air compressor may form an approximate idea of the usual style of an ammonia compressor. Needless to say, they should be as simple as possible and have few working parts. The suction and discharge valves should be made of hard tough steel combined with a maximum of lightness. The suction valves are usually made with a series of small vents which tend to act as a cushion. This prevents the valve lifting too suddenly at the end of the stroke, as the gas cannot escape from the cushion pocket fast enough to allow the valve to hammer against the compression stop. Some builders of single acting compressors put the valves in the piston. This has been found to work very satisfactorily, as when the piston leaves the cylinder head on its suction stroke, it really leaves the valve behind, as it were, and the momentum of the valve will be sure to cause it to close promptly at the very commencement of the return or compression stroke. Prompt opening and closing of the valves will give a maximum efficiency, as the capacity of an ammonia compressor depends upon the number of pounds of ammonia it can pump from the expansion coils.

The discharge valves unlike the suction are found to work best without cushioning, as long as they are provided with a strong spring and have sufficient lift. As the piston reaches the end of the stroke, it is traveling somewhat slower, and as the quantity of ammonia gas is gradually being discharged from the cylinder, by the time the piston has reached its limit of travel, the valve is entirely closed. This greatly increases the life of the valve and also prevents any of the gas which has already been discharged, from coming back in the cylinder, when the piston starts on its return stroke. This is very likely to happen if the discharge valve is cushioned or is late in seating.

*From a paper read at a recent meeting of the Central Railway Club, Toronto.

**Chief Engineer, Gunn's, Ltd., Toronto.

Indirect Expansion System of Refrigeration.

The indirect system of refrigeration is successfully employed when purity of air and an even, but not too low temperature is desired. It is accomplished by placing a series of coils in a loft or galley above the rooms desired to be cooled. These coils are connected with the remainder of the refrigerating plant, and have ammonia circulating through them just as in the direct expansion system. By means of a large fan, the air is drawn out of the room and discharged over the above mentioned ammonia coils; this cycle being continued, the air is kept perfectly pure and at a uniform temperature. In large plants, the coils are kept wet with a solution of chloride of calcium brine. The brine is pumped from a tank immediately below the coils and allowed to drip over same in practically the same manner as the water flows over an atmosphere condenser, but of course in a lesser degree. This keeps the ammonia pipes free from frost which will necessarily give increased efficiency. Care must be taken to keep the brine at sufficient density, as unless this is done it will not absorb the moisture from the air when coming in contact with the coils. A solution of chloride of calcium can be kept liquid at several degrees below zero providing a maximum density is used. The air to the rooms with the indirect system is sometimes conveyed by means of large wooden ducts, each having an arrangement of slides which can be opened or closed as desired to maintain the required temperature.

Artificial Ice Manufacture.

The demand for artificial ice has of late been in excess of the supply and various means are adopted in its manufacture. What is known as the can system is the most common method employed in artificial ice making. A number of cans of oblong shape, each of sufficient capacity to hold about one hundred pounds of ice are placed full of water in a tank. In this tank are contained a series of ammonia coils, immersed in a solution of chloride of calcium brine. The depth of the brine in the tank is sufficient to cover about three-quarters of the whole can, which has been previously filled with water for the purpose of being frozen into ice.

The cold brine in the tank is kept in continuous circulation either by means of an agitator or by a pump, and with the ammonia expanding in the refrigerating coils in the tank, and the brine coming in continual contact with same, the process of ice manufacture is completed. To produce one ton of ice the amount of ammonia circulated through the expansion coils in the freezing tank must be sufficient to cool 2,000 pounds of water from its original temperature, say 85 deg. to the temperature of the tank, which we will say is 14 deg. F. and in addition to this, extract 142 deg. of latent heat. Therefore: 85 deg.—14 deg.$\times$142 B.T.U.$\times$2,000 lbs.$\div$284,000 B.T.U. $=1\frac{1}{2}$ tons refrigeration.

There are generally so many losses incurred due to the leaving the covers off the freezing tank, etc., that a fair average of ice manufacture may be accepted as half the refrigerating capacity of the machine. The longer the ice takes to produce, the clearer it will be, and the higher the temperature of the tank is maintained without actual loss of efficiency, the more economical will be the operation.

Insulation.

In refrigeration practice, the matter of insulation is perhaps of most importance, as the rooms in which goods are stored must be kept at as even a temperature as possible, the variation of a degree or two causing the partial or total loss of a large amount of valuable property. Asbestos, mineral wool, and such material is usually employed for insulating steam mains, boilers, etc., but unfortunately they are practically of no value in cold storage on account of their absorption of moisture.

Scientists for many years turned their attention without success to the ideal insulation, i.e., dead air, which if it could be permanently confined in an air-tight compartment would prove of the greatest value to science. An insulation to be of any value for refrigerating work must be absolutely impervious to moisture, and practically the only material which has met with any degree of success in this particular line is cork. Several substitutes have been tried to supersede cork as an insulation, on account of its being so expensive, but they have nearly all wholly or partially failed to

attain the degree of perfection claimed for them.

Cork is regarded as the only efficient agent at present in service. Under a powerful microscope it is of honeycomb appearance, its air cells are closely sealed and prevent the passage of moisture, as can be seen from a cork in a bottle. Cork is used in its granulated form and in compressed sheets, which are made by mixing the granules with a kind of cement and putting them through a baking process. In selecting cork sheets, it is well to remember that the cork is the insulation, and the more cork and less cement there is, the more value it will be as a non-conductor. The principal parts of a cold storage system to be insulated are the floors, walls, suction and liquid pipes. In several instances, brick walls have been insulated by building them of cellular form, leaving a space of about three inches, and filling this with pitch or asphalt and finishing inside with cement. The asphalt prevents the moisture from passing through the wall, but apart from this, it is of little value.

The usual method of applying cork sheets to floors is as follows:—The floor is first made as dry as possible, then a layer of waterproof paper is laid on same. The cork sheets or slabs are then dipped in a hot preparation of asphalt and laid closely together on the floor, after which hot asphalt is poured completely over the whole surface, and as it runs down between the joints of the segments, it forms practically one continuous sheet. These sheets are two inches thick, two layers being generally laid and the whole finished off with a covering of cement of about three inches thick.

AMMONIA COMPRESSOR SAFETY DEVICES.

By Peter Neff.

SAFETY devices for compressors may be divided into two classes:—First — Those which provide protection against accidents resulting from breakage of parts which go to make up the entire compressor. Second — Those which provide against damage resulting from other than inherent causes. The first class provides against such accidents as the breaking of valves, rupturing of cylinder walls and heads, breakage of piston rods and rings, and the like.

Features of the First Class.

The breaking of the valves in the early days of refrigerating practice was probably the greatest source of damage to compressors with which the manufacturer had to contend. This defect has now to a large extent been eliminated:—

A—By the ability of the manufacturer to secure for the construction of his valves a grade of material which does not so readily tend to crystallize.

B—By constructing the valves so that they are more or less cushioned in their operation, thereby avoiding the shock, which is the greatest factor in producing crystallization.

C—By locating the valves in such a way that the broken parts remain in the pocket in which the valve operates, and cannot enter the cylinder.

This method of avoiding the trouble was condemned for many years, because of the idea that the effect of clearance in the compressor is detrimental to its efficiency, but if the manufacturer constructs his compressor of proper size to allow for the volumetric loss occasioned by these pockets, he is still in position to argue on the question of the true efficiency, which is the ratio of the horse-power required to operate the compressor per ton of refrigeration. Had this been more distinctly understood and properly elucidated, especially in the early days of the art, we believe it would have done much to facilitate the overcoming of this trouble, for had the manufacturer realized that he could have arranged his valves in pockets with perfect safety, and by increasing the size of his compressor could have accomplished the same work as before, with the same expenditure of energy, he would have been able to go before the public with only a little more weight and size to handicap him.

D—By designing the valve so as to eliminate its tendency to crystallize and wear.

E—By the use of a false head in the compressor, covering the entire bore, which is held in place by springs of greater tension than the pressure ordinarily exerted on the head. This method is not applicable except in vertical, single-acting compressors.

The devices and conditions referred to have been brought into use in different combinations by various manufacturers, with the general result, that, as now constructed, compressors are more free from inherent defects than ever before. There is, however, room for improvement, and it would seem that this improvement is to be looked for along the lines of better materials from which to construct the valves; better design by which to avoid unnecessary wear and tendency to crystallization, and more careful locating of these valves.

The structural strength of compressors and compressor heads, has not been a source of much concern, as the manufacturer soon learned that certain grades of material were necessary for the construction of these parts. In many instances, however, compressors are weakened through faulty design where shrinkage strains are not taken into account. Such strains are not always apparent, but may appear as time goes on.

Piston rods and heads have given little trouble, as it has been easy to figure the strains to which they are subjected and to allow liberally for them. As to piston rings, very many types have been tried, some of which have produced accidents; but of late years the ordinary snap ring seems to have best met the conditions of service, and very little trouble should be experienced from such rings if properly made and adjusted.

The first class of safety devices embraces, therefore, nothing but what the manufacturer should be able to control by careful calculations and the results of experience. This also applies generally to what is to be said with regard to the second class. In other words, in the construction of some safety devices, the manufacturer must have in mind liability to accident from causes arising under both classes.

Features of the Second Class.

The second class deals with such accidents as are caused by explosions, unusual pressures, the presence of liquid in the compressor, and the like:

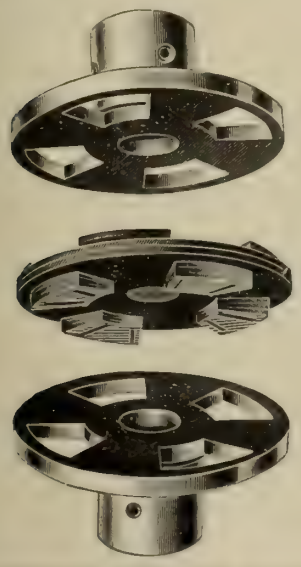
A—As to explosions, the manufacturer cannot protect his product against this contingency by any mechanical device. They usually result from a mixture of compressed air and oil vapors. Other causes have been suggested, but a discussion of this phenomenon is scarcely permissible in this paper. The best guard against such accidents is judgment and care on the part of the operator, but even this does not eliminate a certain percentage of chance, due to the working of unknown laws.

B—For unusual pressures, there is first the general construction, which should provide for ordinary increases of pressure likely to occur. When a machine is started with the discharge valve shut, for example, the power applied is usually sufficient to cause a pressure far beyond that which experience would indicate should be considered in compressor construction. Failure may not take place in the compressor, but in some weaker part of the machine. To avoid this, one method is to make connection between the discharge side pipe of the compressor at a point before it reaches the stop valve, and the suction side of the machine beyond the suction stop valve. In this connection is inserted a relief valve similar to a safety valve. The difficulty with this device is the same as with any steam safety valve. If not used it tends

to become useless, and when used too frequently is apt to leak. The first destroys its purpose, and the latter causes constant loss in capacity and efficiency.

This method, notwithstanding its faults, seems to be the best available at the present time, and should be improved along the lines of better seating and a better arrangement for operating by hand, so that it can be tested daily. Another method has been to make a relief valve of the discharge stop valve. This will take care of excessive pressure in the compressor itself, but is of little value when the excessive pressure extends to the condenser, which may occur under certain conditions, and the method is therefore at best of only limited value.

For protecting against the presence of liquid in the compressor—and here we have a very real and ever-present danger, no matter how carefully the system may be designed—the false head applicable to vertical, single-acting compressors would seem to be all that is necessary, but such a device gives rise to disadvantageous conditions which have to be balanced against the advantages of safety. First, when the false head opens it may or may not close tight again. Second, the construction detracts to a large extent from the usefulness of the cooling water, owing to the gaseous space between the false head and the head proper. In small compressors, where the discharge valve is of the same diameter as the compressor, satisfactory and safe results are accomplished.



NEW FLEXIBLE INSULATED COUPLING.

To avoid this difficulty in vertical and horizontal double-acting types of compressors, the location of the discharge valve must be such as to cause the liquid present to be practically all discharged before the piston reaches the end of the stroke.

There is abundant opportunity for improvement in safety devices for compressors, and engineers should not be content to let well enough alone. We should not be beguiled into believing there is no danger in the operation of compressors. Accidents resulting in loss of life do occur, and life, no matter how infrequently such accidents occur, is a fearful price to pay for the neglect of possible safety devices.—From a paper read before the American Society of Refrigerating Engineers.

NEW FLEXIBLE INSULATED COUPLING.

THE Canadian Bond Hanger & Coupling Co., Alexandria, Ont., in addition to their extensive line of power transmission machinery are now manufacturing the Grundy flexible insulated coupling for direct drives for motors. This coupling is manufactured in three parts, the two outer flanges being of cast iron and the centre disc of specially selected leather or hard fibre with lugs on each side for transmitting the power to the outer flanges. The lugs are securely cemented and riveted to each side, and on the larger sizes are bolted on and reinforced with steel plate.

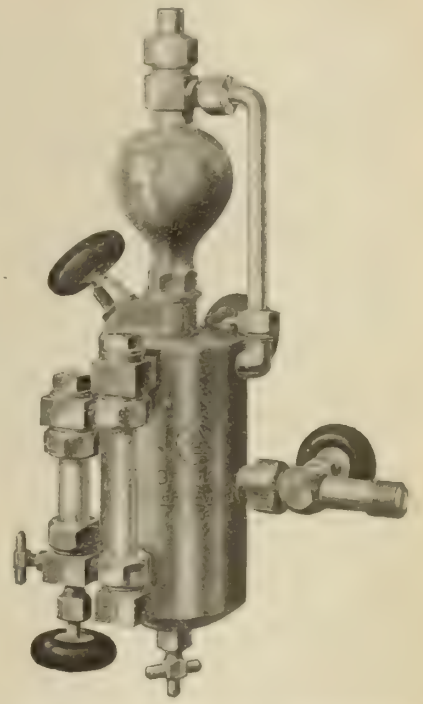
The Grundy coupling is specially adapted for connecting motors to pumps, machine tools, sewing machines, woodworking machinery, printing machinery, fans, blowers, etc. It is a simple and effective device for connecting the two ends of shafting where it is difficult to get the bearings in perfect alignment or where they are liable to get out of adjustment, and is guaranteed by the makers to give less trouble and outwear anything else of its character on the market; at the same time, maintaining a perfect and silent drive in either direction. The "Grundy" can be closely connected, and there are no loose cylinders, rings, threaded pins or bolts to give trouble.

CHATS FALLS DISPUTE.

THERE is prospect of an early settlement of the long outstanding dispute between the Hydro-Electric Commission and the grantees of the power site at Chats Falls, on the Ottawa River. Mr. George Lynch-Staunton, K.C., for the Hydro-Electric Power Commission, and Hon. Wallace Nesbitt, K.C., for the private interests, are to argue the case on April 29. The Ontario Railway and Municipal Board will pay a visit to the locality.

DETROIT "300" GREASE LUBRICATOR.

THE Detroit "300" Grease Lubricator is designed to feed grease, non-fluid oils and similar lubricants evenly, economically and efficiently. It is of like construction to the "Detroit Improved Standard," except that it has a heating passage and a large heating chamber. This heating chamber is of sufficient size to reduce all the lubricant in the reservoir to a thoroughly liquid condition immediately after steam is turned on, therefore, no time is lost waiting for the lubricator to warm up preparatory to feeding. Cold drafts, outside exposure or temperature variations do not affect the operation, the oil or grease in every part of the lubricator being maintained in a fluid condition at all times with an even rate of feed, through fine regulation. Maximum economy is, therefore, assured.



DETROIT "300" GREASE LUBRICATOR.

This lubricator can be installed either with both connections between the boiler and the throttle, or with the condensing tube above the throttle and the delivery or support arm below the throttle. In order to permit of either installation, there is attached to each lubricator, properly tagged with complete instructions, a choke to be screwed into the support arm in case the connections are made on both sides of the throttle. If both connections are above the throttle, the choke is not required.

The Detroit Lubricator Co., Detroit, Mich., are the makers of this specialty.

THE READERS' POINT OF VIEW

Devoted to brief descriptive article contributions covering ideas and experiences pertaining to power plant practice and operation. We pay for accepted material.

WHAT SHOULD A FIRST-CLASS OPERATOR KNOW?

By J. T. A.

ON the subject of a first-class engineer's knowledge, I have contributed frequently to the engineering journals of Canada and United States, and as there is a chance that we operators of Ontario may soon have the privilege of first-class examinations, it may not be amiss to look a little further into the matter.

Let me say at the outset, that unless the examinations are planned along sensible lines, that engineers may not find conditions altogether to their liking. A difference of opinion exists as to the nature of such examinations, some operators believing that nothing beyond power plant experience and practical questions relative to plant equipment and operations is necessary. Others, again, think a first-class man should have several years shop experience in addition to that gained in the power plant, and still others state that it is all "tommy rot" to grant a man first-class papers unless he is well up in the theory as well as the practice of engineering. A fourth lot will say that a first-class certificate man should have all the qualifications already enumerated, and, in addition, should be a fair mechanical draftsman with drafting room experience; in a word, that he should be capable of designing and superintending the building and erection of any class of power plant equipment. He should also have a high school education. If the examination be along the lines of the latter requirements, then there will be few men holding first-class papers.

Let us look at things from the common sense point of view. No doubt, the applicant should have several years' experience as engineer in charge of a power plant over 100 horsepower, for he might be a machinist, draftsman, college or high school graduate, designer, erecter, etc., and lack the most important of all, practical experience in charge. There is no doubt that a man who is a machinist will be more valuable as an employee than one who is not, and the same can be said about the shop draftsman, but, tell me, gentle stranger, how many of these men will leave good paying positions to start in and learn the business of stationary steam engineering; not one in a thousand.

It has been said that engineers are born, not made; this is not true. If any man has some natural talent and is given opportunity to secure instruction and gain experience, and uses determination to overcome the various obstacles in his path, he can qualify for what a first-class engineer should be. What is the sense in making a man answer a lot of questions which not one engineer in a thousand will ever meet with in power plant operation? If a man answers the questions on some first-class examination papers which I have seen (outside of Ontario), he should have conferred upon him the degree of Bachelor of Engineering.

It is said that shop and drafting room experience enables a man to see into things, yet these same kind of men have been stuck on simple power plant problems that any third-class practical engineer could handle. An engineer who has taken and completed a correspondence school steam engineering course should be able to answer any technical question embodied in a first-class examination. He should, in addition, have had at least six years' practical power plant experience with several years in charge.

Now, do not misunderstand me. A man cannot know too much of the theory of his work, the more he studies the better for himself and his employer, but when an examination is made next thing to impossible, it opens the way for graft, for many men holding good paying and responsible positions will part with considerable coin rather than lose their position through not having first-class papers. This has been proved in the past when examinations were made too severe for the man with an average education, although of unlimited experience.

There is so much equipment in a modern power plant now-a-days that it is impossible for any one man to be an expert in every different line represented there. He must know something about chemistry, hydraulics, etc., refrigeration, electricity, drafting, machine work, condensers, steam heating, etc.; any one of these things alone, requiring years of study and experience to master. Questions dealing with most of these subjects when used at engineers' examinations, should be those which the engineer would be most apt to know.

It would be interesting to get the opinions of engineers who have passed the first-class grade in some of our Canadian provinces.

PUMP CONNECTIONS.

By H. Westwood.

REFERRING to an article in a recent issue of The Power House, entitled, "Pump Connections," by James Ellethorn, I fail to see why he should connect the ¼-in. by-pass from the live steam pipe which runs the pump, with the exhaust pipe in order to operate his pump condensing. The article states, that by opening this valve for a few seconds, the pump will take water immediately.

This is altogether unnecessary for a pump coupled up in the ordinary way, and has nothing to do with running condensing. I have coupled up several pumps to run either condensing or non-condensing in the past seven years, and all that I found necessary was to start the pump, then open the valve between the suction and the exhaust, and then close the valve leading to the atmosphere. The pump will run faster, and heat the water also.

The capital stock of the Trussed Concrete Steel Company of Canada, Ltd., has been increased from $200,000 to $500,000.

BORING A 30-IN. SLUICE VALVE FOR SASKATOON WATER-WORKS.

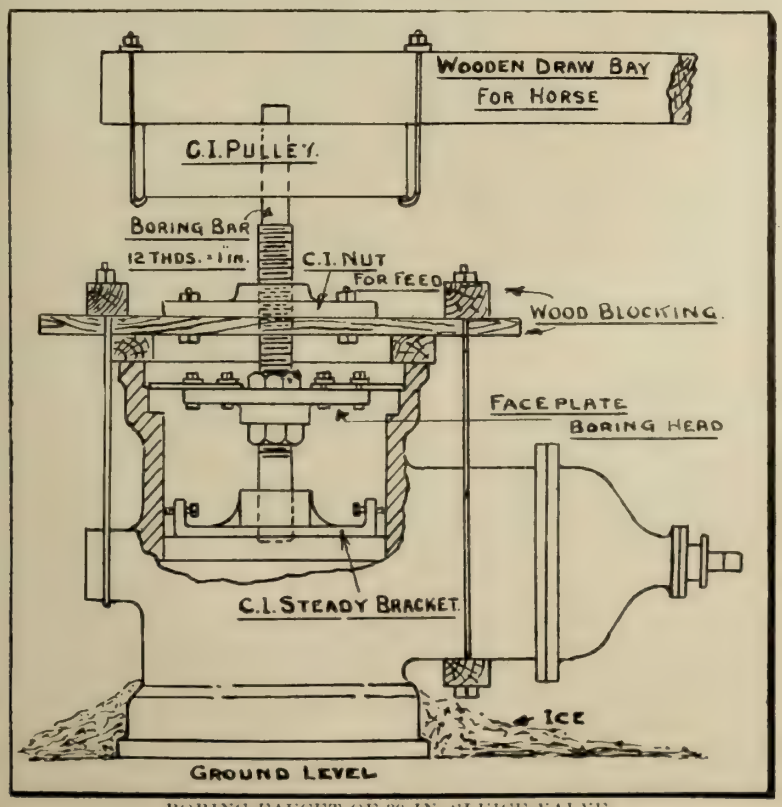
By D. M. Bright.

THE faucet on the valves was ¾-in. too small in diameter for the spigot of the pipes, and as the valves were urgently required, the services of John East, proprietor of a small foundry and machine shop in Saskatoon were requisitioned.

The accompanying sketch shows how the job was set up, an interesting part of the work being that of fixing the valve to the ground. This was accomplished by one of the simplest "chucking" methods yet discovered. The valve was set up, one face on the ground and banked round with snow, to which was added a few buckets of water. This soon froze solid, the temperature being 48 degrees below zero, and, needless to say, there was no movement of the valve during the boring. The boring bar was a piece of 3-in. mild steel turned and screwed where shown, 12 threads to 1 inch. It served as feed screw, and also to hold the boring plate, which was the face plate of lathe held secure by nuts at top and bottom. To this plate was fixed two cutting tools, as shown. The feeding was done through the cast iron plate screwed to fit boring bar and bolted to top of planks, the latter being held in place by struts and tie bolts. On the upper end of boring bar was keyed a strong cast iron pulley, with a piece of timber to hitch the horse to. The guide for bottom end of boring bar was a plain three-winged casting, with lugs to take set screws for centring, having a boss in centre bored to fit bar, and long enough to allow for full travel of cut without the bar coming in contact with gate of valve. When the job was set, the horse was started, and the men returned to their other work in the shop, only keeping a look out now and then to see that he was still going. Two cuts completed each faucet, and the work was so smooth that a groove had to be made to hold lead.

Three faucets were bored out in four days, which time included making of tackle. The horse was an old timer, having served ten years with a local contractor on capstan work shifting buildings. The writer secured photo and data of this job when visiting Mr. East's shop, and considers it as clever a bit of work under the conditions as he has ever seen.

BORING 30 IN. SLUICE VALVE, CHUCKED TO EARTH AT TEMPERATURE 48 DEGREES BELOW ZERO.



BORING FAUCET OF 30-IN. SLUICE VALVE.

VALVES IN PIPE LINES.

WRITING on "Valves in Pipe Lines" in the columns of the Power User, Mr. J. S. Leese points out that the abuse of valves is a common cause of accident in the steam power plant. A valve in a live steam line, he maintains, should never be opened or closed quickly. In one recent accident a stop valve chest exploded under water hammer set up by turning live steam into a cold and badly drained steam pipe. In another case an explosion occurred owing to unbalanced pressure at the initial opening of a boiler shop valve. This raises the question, why should not all valves on live steam lines be provided with by-passes? The extra cost would be justified by the lessened risk to life and property, and where there is admittedly such a risk it would appear to be almost criminal not to take every possible precaution to guard against accident.

A prolific cause of accidents, Mr. Leese goes on to explain, is the tightening of leaking valves with spanners and crowbars. A recent case, resulting in the killing of one man and maiming two more for life, occurred when a valve yoke broke under this treatment, allowing the steam to lift the throttle and carry the water of condensation into the steam chest, blowing the steam chest cover out by the force of its impact. A valve should in no circumstances be closed further than it can be with the hand-wheel supplied with it; if it leaks then, it is high time to take it down and examine it for the cause of the leakage.

George W. Thompson, who was superintendent of the light and power department of Westmount, has been appointed acting manager of that city's affairs until November next. His salary will be $5,000. The new position is really that of city controller.

PROGRESS IN NEW EQUIPMENT

There is here provided in compact form a monthly compendium of the power plant manufacturers' achievements.

A MECHANICAL CYLINDER LUBRICATOR.

FOR the lubrication of engine cylinders by force feed, the Lunkenheimer Co., Cincinnati, Ohio, has developed a new type of mechanical oil pump. It possesses a number of interesting features, among which may be mentioned the accessibility of the parts, regulation of the feed with provision for supplying a greater amount of oil than usual in case of emergency, ease of filling and a sight feed for every outlet. Three sectional elevations are reproduced in the accompanying drawings.

Lubrication of engine cylinders by force feed has been proven to be by far the most satisfactory. It is not only more efficient, but it is also more economical. To obtain satisfactory results however, by force feed lubrication, great care should be exercised in the selection of a properly designed oil pump, and unless one is used that is absolutely dependable, practical and durable, the old method of hydrostatic lubrication had better be resorted to, as considerable damage may result from a poor pump.

In order to secure the greatest durability possible in this particular apparatus, such materials have been selected as will give the best results when working one against the other. Those parts subjected to the greatest wear are made of hardened tool steel. In addition, all parts of the pump are readily and easily replaced when necessary.

Feed Regulation.

Attached to the operating rod RB-1754 Figs. 2-3-4, is an adjustable coupling B-50375 which can be moved up or down on the rod, and its location should be governed by the speed of the engine. If a high-speed engine, the coupling should be placed some distance from the end. The longer the stroke of the rod, the greater the supply of oil.

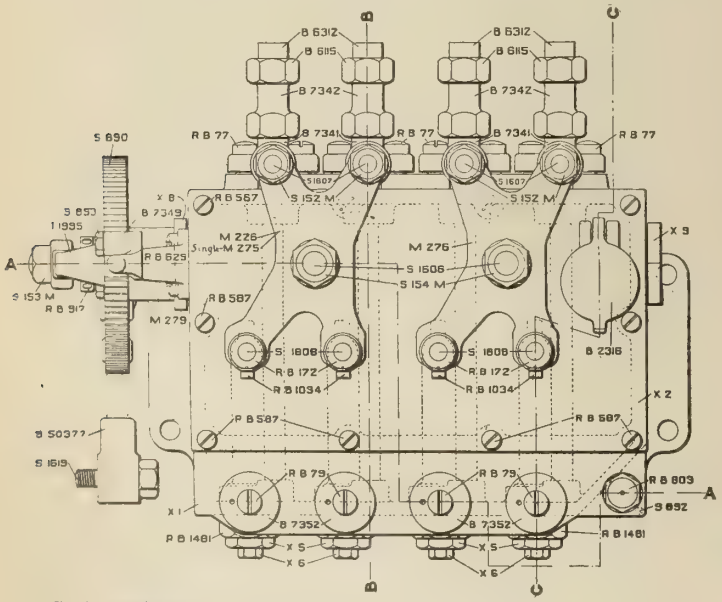


FIG. 1. MECHANICAL CYLIND ER LUBRICATION. TOP VIEW.

Adjustment of the quantity of oil per stroke of piston is made by the nut RB-172, attached to the end of the piston S-1608, Fig. 3. By means of this nut, the effective stroke of the piston can be regulated; the lower it is permitted to travel, the more oil is pumped. Spring SB-60 is provided to prevent the regulation from unsetting.

Every oil outlet has its own pump and feed regulation, so that different quantities of oil can be supplied from the different outlets, or if desired, the piston S-1608 of any outlet can be raised sufficiently to prevent the hole (B) in the base of the cylinder X-4 from being covered during the travel of the piston, and thereby entirely stop the flow of oil.

Should an emergency arise requiring the forcing of a greater amount of oil than that regularly supplied, this can be done by turning the ratchet wheel by hand, by means of the yoke I-1995 Fig. 2. Any amount desired can thereby be supplied, whether the pump is operating or not.

Large Filling Hole.

The reservoir is easily filled with oil, owing to the large size of the filling hole. A hinged lid cap is provided

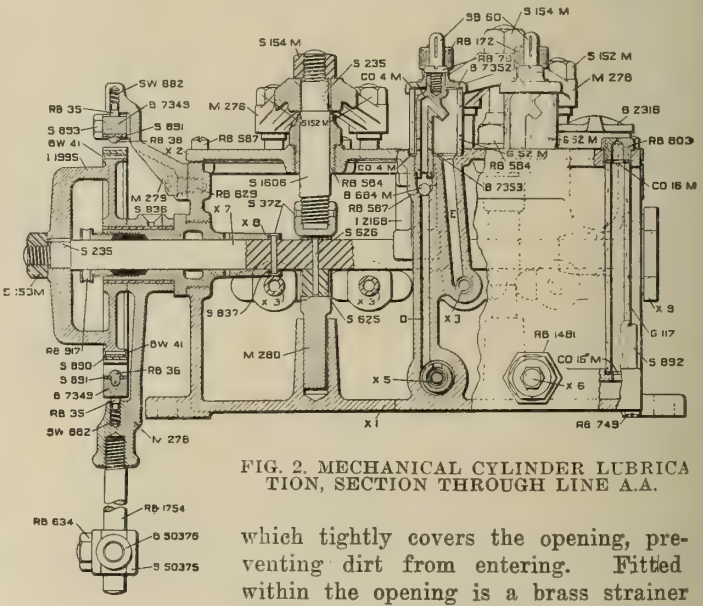


FIG. 2. MECHANICAL CYLINDER LUBRICATION, SECTION THROUGH LINE A.A.

which tightly covers the opening, preventing dirt from entering. Fitted within the opening is a brass strainer BW-146, of very fine mesh, which can easily be removed for cleansing.

This feature is very important, as it enables the engineer to ascertain at a glance whether the various cylinders are being properly lubricated, and he can rest assured that every drop of oil seen passing through the sight-feeds will positively be forced to the particular cylinder for which it is intended. The sight-feeds are exceptionally large and the dropping oil can plainly be seen from a distance.

Operation.

Although the cuts shown illustrate the Lunkenheimer Four Feed Lubricator, the

operating description applies equally to the one, two and three feed mechanisms.

After the lubricator is properly located, the coupling S-1619 should be attached to the eccentric rod or other suitable moving part of the engine. The gauge glass G-117 is provided to show the quantity of oil contained in the reservoir.

The driving mechanism is of the ratchet type, the ratchet plate S-891 engaging with the teeth on the driving wheel I-1995 on every forward stroke. An arm M-279 carrying a spring actuated pawl, is provided as a brake for the driving wheel, holding the wheel to the amount of motion imparted by the ratchet arm M-278, and also preventing the wheel from being turned backwards.

The wheel I-1995 is keyed to the shaft X-7 and controls its movement. Rigidly fastened to the shaft are case hardened steel eccentrics S-625, which operate in yokes M-280. These yokes are suitably connected with the plunger plates M-276, and as the eccentrics revolve, the plates are made to move up or down. Attached to the plates M-276 are two plungers, the one S-1608 for forcing the oil through the sight-feed G-52-M, and the other S-1607 for forcing the oil to the cylinders of the engine.

On the up stroke of the piston S-1608, oil is drawn into the passage (A), through the drill hole (B) and into the bottom of the piston cylinder (C). On the down stroke of the piston, the drill hole (B) is covered by the piston and the oil in (C) is forced past the check ball B-684-M, around the tube X-5, up passage (D), past check ball at the top of this passage and then through the sight feed. When the plunger S-1608 moves upward, both check balls in the passage leading to the sight-feeds close, thereby preventing the oil from flowing back into the reservoir.

The oil from the sight-feeds flows down the passage (E), Fig. 2, through the tube X-3 into the cylinder casing B-7341, from where, on the up-stroke of the piston S-1607, it is drawn past the check balls B-1281-M and B-104-M, into the cylinder. On the down stroke of this piston, the balls B-1281-M and B-104-M close and the oil entrapped above them is forced past the outlet check balls B-684-M into the engine cylinder to be lubricated.

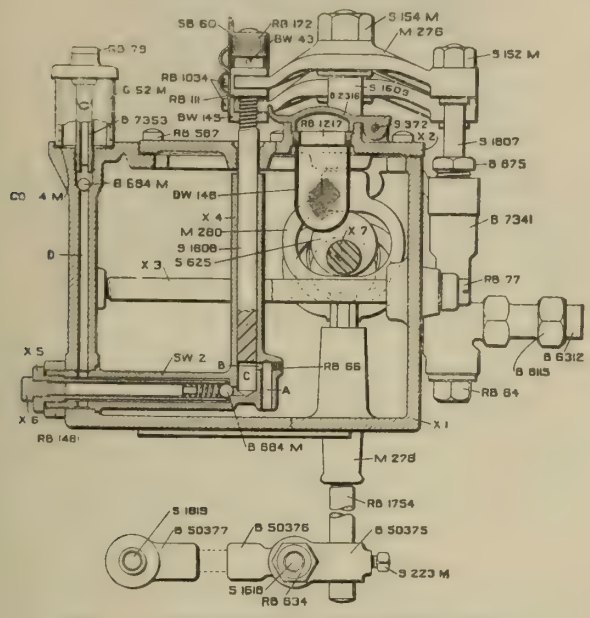


FIG. 3. MECHANICAL CYLINDER LUBRICATION. SECTION THROUGH LINE C.C.

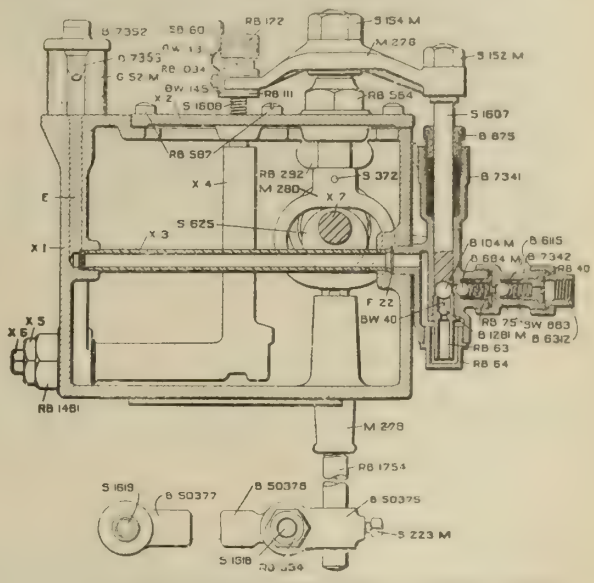
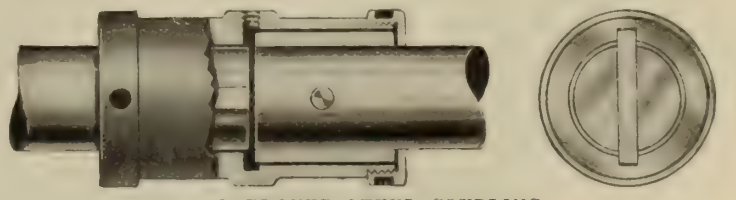


FIG. 4. MECHANICAL CYLINDER LUBRICATION. SECTION THROUGH LINE B.B.

IMPROVED STEEL COUPLING.

A NEW form of flexible coupling, made entirely of crucible cast steel and to dimensions especially suitable for this material, has been introduced by McEwan Bros., Wellsville, N.Y. This McEwan coupling illustrated herewith, is said to have the smallest diameter and mass, and, therefore, the smallest inertia of any truly flexible coupling on the market. The keys which extend clear through the shaft, are set at right angles and are arranged to permit a marked degree of misalignment, yet because of ample key bearing surface and exceptionally good lubrication from packing of heavy oil or soft greases, there is no noise or tendency toward serious wear. The design is particularly good for withdrawals parallel to the shaft axis, and very small clearance is required for removing any part.

This type of coupling was first used and has been given its severest test upon McEwan Bros. pumps direct connected to steam turbines running 24 hours per day for months at a time. The satisfaction which it has given under these high speeds and other severe conditions, such as reversible motor drives for machine tools, would seem to indicate a general usefulness for blower, rotary pump, motor, generator, turbine and line shaft connections, and for other machinery running at high speeds.



IMPROVED STEEL COUPLING.

A NEW UNDERFEED STOKER.

CONSPICUOUS features of the new Riley Self-Dumping Underfeed Stoker are those of moving fuel bearing grates in place of stationary tuyeres, and moving underfeed grates extending across the entire width of the furnace. Those moving grates carry the fuel down an incline of about 20 degrees and the positively forced feed, made up of the combined motion of a plunger in the retort and the moving grates, distributes

the coal evenly. The number of retorts and plungers depends on the width of the stoker.

The overfeed grates act in unison with the underfeed fuel-bearing grates and also with the plunger, receiving motion from extensions of the plunger wrist-pins. Each fuel-carrying grate is supported at its upper end by a rod parallel with the coal ram. In the ends of these rods are bolts passing through holes in the plunger pins. By this arrangement, although the plungers make full travel, the movement transmitted to the reciprocating grate is less, due to the lost motion made possible by the distance between the heads of the bolts and the ends of the rods. This lost motion is adjusted by distance blocks to suit the character of the fuel.

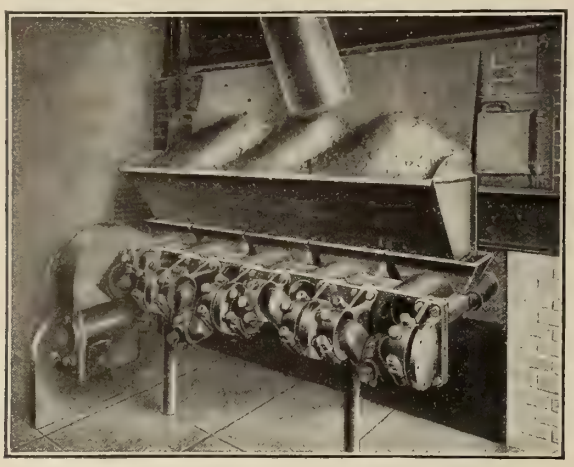


FIG. 3. FRONT VIEW OF STOKER.

FIG. 2. RELATIVE POSITION OF MOVING PARTS.

The discharge of refuse is continual and automatic. At the lower end of the overfeed grates are pusher noses which force the refuse slowly, but continuously toward the bridge, then on and over the ash supporting plates, which are hinged together in the form of an apron. The plates of this apron hang down over the ends of rack which controls the size of the opening and is adjustable by hand power. The discharge capacity can be regulated by the amount of travel given to the pusher noses. An idea of the ash apron construction can be obtained from the sectional view through the stoker. Two I-beams, carrying the supporting plates and self-dumping adjustment, constitute one assembly unit, while three heavy angles, carrying the cylinders and crankshaft, constitute another assembly unit. Each of these units is separately installed and the moving retort parts are dropped into place. The retort bottoms are fixed at their upper ends and their furnace ends slide on the reciprocating over-feed grate extensions.

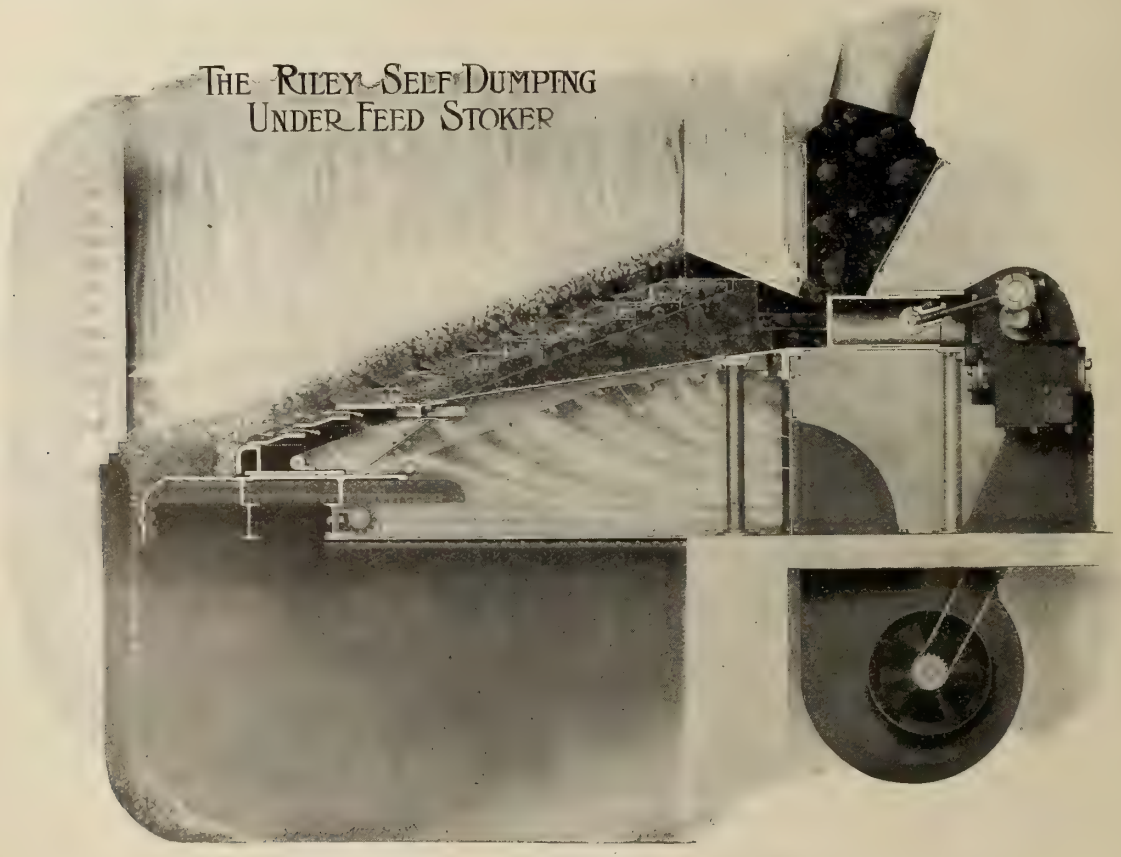


FIG. 1. SECTIONAL VIEW THROUGH STOKER.

Precaution against possible damage

by obstacles blocking the movement of the plungers is had by using a hardened-steel ring with a pin passing through it and the connecting-rod. The ring bears against the end of the forked sleeve mounted on the wristpin, so that the thrust on the plunger tends to shear the pin. If the pin shears, because of an obstruction in front of the plunger, the connecting-rod slides idly through the sleeve between the ends of the wrist-pin without carrying the plunger with it. The pin is easily renewed while the stoker is in operation. This safety device is equally effective for all positions of the crankpin.

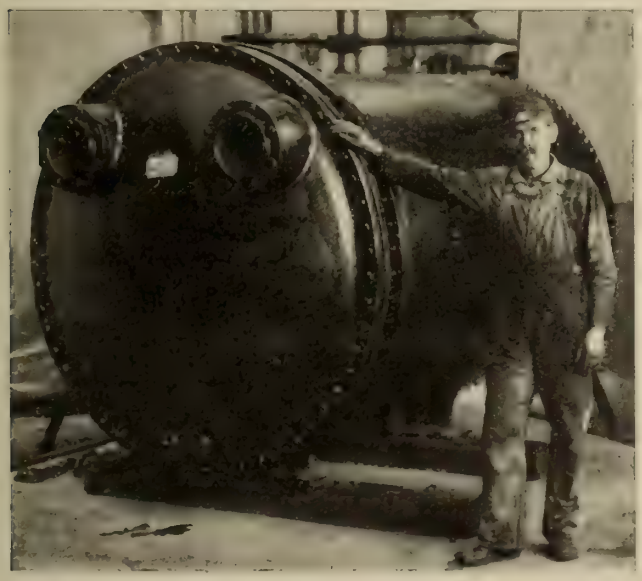
Connection between the blower and the stoker is by a chain and sprocket wheel, one of which is shown in the sectional view. The other sprocket delivers power to the gear mechanism which drives the plungers. The stoker and fan work in unison. As the sprocket wheels are placed on the shaft and not removable by the attendant, the ratio of air to the coal fed to the grates is fixed. This adjustment is determined by the flue-gas analysis and so long as the same grade of coal is used, the sprocket wheel should not be changed.

Referring to the sectional view, the course of the fuel is easily followed. Dropping from the stoker hopper it is forced into the retorts by the plungers operated by the crankshaft on the front of the furnace. When the retorts become filled, the fuel is carried by the fuel-bearing grates which form the side of the retorts. As these grates are operated in unison with the retort plungers and as each pluger is driven by a crank, set at a different angle from the one beside it, the fuel-bearing grates between any two retorts are given a shearing motion in relation to each other, while moving in opposite directions; this prevents clinkers forming above the air openings. The reciprocating motion of the fuel-bearing grates gradually forces the coking and burning fuel towards the rear end of the furnace. Air is supplied to the fuel through the side tuyere openings.

The driving mechanism of the stoker is visible from the outside and accessible. The air space beneath the stoker is reached through a door, or through the opening in the front air plate or by the side door Removing the front air plates, gives free access to the under part of the stoker for repairs, etc. The stoker requires a small amount of head room, which permits of ample combustion-chamber space. The short air duct between the fan blower and the air space below the stoker is seen in the sectional view. This feature eliminates losses due to the friction of air through long air ducts and the necessary power to maintain the excess air pressure to overcome this loss.

As the overfeed grates extend entirely across the stoker beyond the underfeed retorts, all of the partially burned fuel comes in intimate contact with air, and the latter being of less pressure than the underfeed air is not destructive to the lighter fuel bed on the overfeed grates. At low ratings, this air pressure may be little or nothing, being regulated by the fireman operating the damper shown in the sectional view, between the air space and the overfeed reciprocating grate.

The Sanford Riley Stoker Co., Worcester, Mass., are the builders of this stoker.



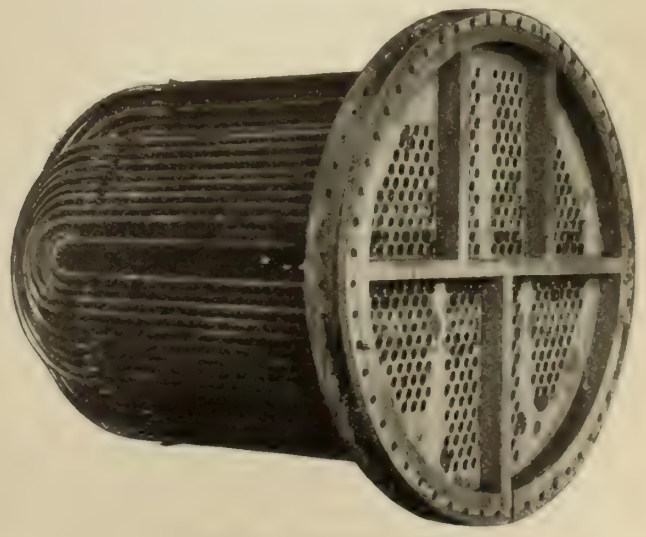
LARGE HOT WATER HEATER.

LARGE HOT WATER HEATER.

ONE of the largest hot water heaters yet built was recently manufactured by the National Pipe Bending Co., New Haven, Conn., for the Wood Worsted Mills, Lawrence, Mass. This heater of the "U-Bend" type has a capacity of 125,000 pounds of water per hour, heating it from 100 degs. to 212 degs.by exhaust staem. It sets horizontally on cradles, is almost 9 feet long, 5½ feet in diameter, and contains 212-1¼ in. brass tubes expanded into a header.

The water enters at the front through an 8 in. inlet, and flows through a bank of tubes, passing longitudinally from front to rear, then to the front again, and again to the rear, making four passes before leaving through a water outlet of the same size, also at the front. The water is compelled to travel through the tubes explained above, by means of baffles on the header. These baffles divide the space horizontally into two main sections, and other baffles divide the upper section into three parts and the lower section into two parts as shown by the accompanying illustration.

The steam enters a 10 in. inlet at the top, and entirely surrounds the tubes, the condensation leaving the heater by a 4 in. drain at the bottom. All the tubes are brass; these having, in consequence, no action on the water, making it suitable for washing or boiler feed. The shell, of steel plate, is not liable to corrode, because it is not in contact with the water.



LARGE HOT WATER HEATER.

This apparatus can be used as a storage heater by reversing the action, that is, directing the steam through the tubes which are then surrounded with water. As a result, the water while larger in quantity, would be of lower temperature.

POWER PLANT DEVELOPMENTS

A record of current municipal, manufacturing and general industrial projects, involving steam, gas, oil, electricity, air and water power equipment requirements.

Electrical

Calgary, Alta.—The city may spend $500,000 on its own power plant.

Harriston, Ont.—A new electric lighting plant has been installed by the city.

Melfort, Sask.—Contracts have been let for the building of a new power house.

Brantford, Ont.—The Hydro power for the pumping station is costing $23.65 per h.p. per year.

Montreal, Que.—The Montreal Tramways Company will spend more than $2,000,000 in improvements.

Kingston, Ont.—The manager of the city's power plant expects to cut the price to 1.20 cents per k.w. hour.

Hamilton, Ont.—The Hydro-Electric Commission will reduce the price of power here to $15 per h.p. after Oct. 1

Montreal, Que.—The Bell Telephone Co. will lay underground conduits on fifty main streets at a cost of $200,000.

St. John, N.B.—Work on the dam for the Hydro-Electric Company in Charlotte County will be started immediately.

L'Avenir, Que.—The L'Avenir Telephone Co., has recently been organized and is inviting the supply of general telephone equipment.

London, Ont.—The London Electric Company will install two turbine steam engines of 500 h.p. each, and much electrical machinery.

Cannington, Ont.—On April 15th the ratepayers will vote on a by-law to raise $12,000 to provide a plant for distributing Hydro-Electric power.

Welland, Ont.—The Welland Electrical Co. are taking contracts for 3 and 5-year terms at a low flat rate, to compete with the Hydro-Electric system.

Souris, Man.—The Council will consider a by-law to provide electric light and power. Cluster lights will be used, and pumps and motors purchased.

Sackville, N.B.—The Canadian Appraisal Co., of Montreal, will send a man here to appraise the lighting plant which the city contemplates purchasing.

Toronto, Ont.—The city will install a turbo-electric generating unit of almost 7,000 h.p. at John Street pumping station as an auxiliary. The outfit will cost $95,000.

Stratford, Ont.—The plant of the Electric Meter and Stamping Co., of New Hamburg, of which Mr. John Messner, is the head, was slightly damaged by fire recently.

Montreal, Que.—Plans are being prepared for a telephone exchange at a cost of $100,000. W. Carmichael, Notre Dame and St. John Streets, Montreal, has charge of the plans.

Brantford, Ont.—Residents of Brantford Township in Echo Place, a suburb of the city, have petitioned for the installation of Hydro power. Parkdale and Grandview will follow.

Toronto, Ont.—The Northern Electric and Manufacturing Co. has plans for a new factory of structural steel construction, estimated to cost $100,000. New equipment will be required.

St. George, N.B.—Plans are being prepared for 3 concrete dams to develop electricity for St. George Hydro-Electric Co. Cost, $1,500,000. President, Percy W. Thompson, St. John, N.B.

Lethbridge, Alta.—City Engineer Blanchard is working on plans for a new filtration plant. It will be a duplicate of that in Saskatoon, and will cost $75,000. Building will start this spring.

Montreal, Que.—Allis-Chalmers Bullock shareholders will be asked on April 14th to consider a plan for selling the company's entire property, and to authorize the directors to complete arrangements for same.

Toronto, Ont.—The Buffalo & Fort Erie Ferry and Railway Co. are seeking power to electrify their line from Fort Erie to Buffalo. They will spend $300,000, including $50,000 on two ferry boats, and $75,000 on a third.

Hamilton, Ont.—The city council passed a by-law on March 10, providing for the election next January of two members of the board to manage, with the mayor, the Hydro-Electric power plant, each member to receive $1,000 salary.

Nelson, B.C.—The Waneta Development Co. will spend $75,000 on its proposed power plant on the Salmon and Pend Oneille rivers. The initial power developed will be 200 h.p. A power line will be constructed to Sheep Creek and possibly to Salem. David Wilmsley, of Nelson, is a director.

Sydney, N.S.—Extensions planned by the Cape Breton Electric Co. include additional cars, increased car house at Sydney, double-tracking and sidings, a steam unit at North Sydney as an auxiliary, turbine unit, boiler and other equipment for Sydney power station. Expenditure will exceed $350,000.

Montreal, Que.—The Sherbrooke Railway & Power Co. have just completed a contract for 500 additional h.p. to be delivered to a new company about to start operations in Sherbrooke. The contract calls for delivery of power by the fall. This makes 3,000 h.p. the company has now under contract, or about three-quarters of its total output.

West Hamilton, Ont.—An electric lighting system, for Ontario Hydro-Electric Power Commission will be installed. Chairman of Local Commission, R. W. Karch, Dundas. Will require poles, insulators, 600 ft, steel guy wire, galvanized, 1,200 carriage bolts, cross arms, lightning arresters, 22,800 ft. copper wire, 2-5 kw. transformers, power; 1-5 kw. transformer, lighting; 3-10 kw. transformers, lighting; 7,300 lbs., copper wire for streets.

Hamilton, Ont.—The Cataract Power Company has announced a reduction of 25 per cent. in its commercial lighting rates. In announcing the cut, the company has made the following statement: "The fact that we have now reduced

our former rates by 25 per cent. means that we will supply commercial lighting power at less than cost. We will lose money, but we prefer to stick to our old customers.''

Berlin, Ont.—Hon. Adam Beck, chairman of the Hydro-Electric Commission, has notified the Berlin Light Commission that the cost of street lighting for this year in the city would be $16,000. When estimates were being struck by the City Council, it was found that the 1,650 lights installed last year would cost over $17,200, and this amount was reduced $1,000 by cutting out lights in outlying districts.

Robert Howe, M.E., C.E., one of the best known mining and civil engineers in Toronto, passed away on Thursday, April 10, at his residence, 20 Sussex Avenue, in his 75th year. Born in Lancashire, England, in 1838, he was the son of the late William Howe, of Clay Cross, England. Since coming to Canada he had followed the profession of mining engineer, and for 20 years was with the Canadian Fire Underwriters' Association as chief municipal inspector.

Windsor, Ont.—Applying the Hydro radial scheme of the Ontario Government to the Edison Co. power scheme for Essex County, American capitalists have under consideration the construction of an electric railway along the Edison power line from Amherstburg to Kingsville. It is expected the line will follow Lake Erie, running through Masonic Park at Bar Point and touching a number of Summer resorts. It is said to be the intention to start construction work some time during the summer.

Toronto, Ont.—Announcement has been made by Hon. Adam Beck that the Hydro-Electric Commission will at once advertise for tenders for the construction of the transmission line from Dundas to Windsor.. The cost of the extension will be several million dollars. It was announced also that the commission will call tenders for the material for the construction of lines from Cannington to Beaverton, from Berlin to Elmira, from Clinton to Goderich and from Brantford to Paris. This material it is expected, will cost two million dollars.

Windsor, Ont.—Bills of sale record the transfer to the Essex County Light & Power Co. of four private companies, the Amherstburg Electric Light, Heat & Power Co., Ltd., the Essex Light & Power Co., Ltd., the Leamington Light & Heat Co., Ltd., and the Kingsville Electric Light Co., Ltd. The sum of $59,550 is being paid for the franchises of the Canadian towns, and the same company is purchasing two electric businesses in Detroit. The Essex Light & Power Co. is the Edison Light Co., of Detroit, and the merger is taken as an indication of stronger competition for Hydro-electric.

Berlin, Ont.—The Light Commission has received an order for 500 horsepower of Hydro energy from the Dominion Tire Co., to be delivered by September 1st of this year. In addition to this large order, 800 horse-power will be added to the demand on the plant by local industries and the waterworks system, making the total increase of load this year, 1,300 horsepower. It will be necessary for the Hydro Commission to increase the capacity of the local transformer station at an early date to supply the great demand for Hydro power in this industrial centre, and the Light Commissioners will wait on Hon. Adam Beck very soon to secure an addition to the station as soon as possible.

The Western Canada Power Co., Vancouver, B.C., about whose contract with the British Columbia Electric Railway for the supply of power we have informed our readers recently, have placed the contract for two 13,000 h.p. Double Francis Turbines with Messrs. Escher Wyss & Co., Montreal, these units to be installed at an early date. Escher Wyss & Co. will, at the same time, supply two inlet drum gates. The dam at Stave Falls will be raised to elevation 240 ft. so as to create additional storage capacity in the Stave River and the Stave Lake. A second installation, about three miles down stream, will be taken in hand shortly and a further 60,000 h.p. developed there.

Municipal

Strassburg, Sask.—A by-law will be submitted to the burgesses on April 14 calling for the raising of $12,000 to cover cost of an electric light system.

The City of Brandon, Man., has passed a by-law to make the city electrician the ascertaining and determining officer with regard to local improvements of standard street lighting, instead of the city engineer.

Winnipeg's Water Problem. — The board of consulting engineers for the proposed Greater Winnipeg water district scheme will consist of Frederick P. Stearns, of Boston, Mass., who has been one of the consulting engineers of the Panama Canal, the Los Angeles aqueduct, and the New York aqueduct; Rudolph Herring and James H. Fuertes, both of new York, who were members of the 1907 board. The board will assemble in Winnipeg on May, 10.

Water-Works

Mimico, Ont.—The town is contemplating the purchase of a waterworks system.

Wallaceburg, Ont.—The town has engaged an expert to report on a new waterworks system.

Edmonton, Alta.—Water meters will be purchased by the city commissioners. Clerk, Chas. E. Cox.

Crowley, Alta.—The city contemplates the expenditure of $10,000 for the installation of a waterworks system.

Wallaceburg, Ont.—The ratepayers will vote on a by-law, to spend $130,000 for waterworks, on June 2.

Hull, Que.—A waterworks will be constructed at a cost of $50,000. Engineer-in-charge, J. A. Laforest, C.E.

Redcliff, Alta.—The ratepayers have decided to purchase the waterworks, and will spend $20,000 in making improvements to the system.

Arnprior, Ont.—Trouble has been experienced by the town with a pump at the waterworks. Engineer McRae, of Ottawa, is being consulted.

Lethbridge, Alta.—The city will purchase booster pumps, watermains, and will erect a water tower to increase the pressure. A filtration plant will also be built.

Calgary, Alta.—The Calgary Power Co. will develop another water power at Kananaskis Falls, spending $1,000,000 on the project. The new plant will be ready next January.

Winnipeg, Man.—The contract for the construction of an 18,000,000 gallon reservoir will be awarded shortly. It will cost $80,000 and the board of control recommend that the work be given to the engineer of construction.

St. Thomas, Ont.—Waterworks to cost $105,000, are contemplated by the city council. Plans have been prepared to lay a 20 in. main, erect a standpipe and put in new boilers at the pumping station. Engineer in charge, James A. Bell.

Refrigeration

Montreal, Que.—The Bonsecours Market is being equipped with two 30 ton double acting belt driven "York" refrigerating machines.

Edmonton, Alta.—Edw. J. Dahms & Son contemplate the erection of a cold storage and ice making plant, and are investigating cost of machinery, plans, etc.

Vancouver, B.C.—The Vancouver Club is having its club house equipped with a 6 ton vertical, belt-driven refrigerating machine, furnished by the York Manufacturing Co., York, Pa.

Ottawa, Ont.—The Ottawa Artificial Ice Co. who are building a 50 ton ice making plant, have awarded the contract for machinery, including a 60 ton evaporating system, to the Triumph Ice Machine Co., Cincinnati, O.

Prince Albert, Sask.—A five-storey brick cold storage building is being built here, 42 x 66 feet, with eight rooms. The machinery has been installed by the Winnipeg Refrigerating and Engineering Co., the compressors being 20-ton, Baker machines.

Hamilton, Ont.—The Fowlers-Canadian Co. have closed a contract for a 75-ton refrigerating machine for their Hamilton plant. This machine will be a new type, extra heavy duty safety compressor, and is being furnished, together with ammonia condensers and high pressure side, by the Huetteman & Cramer Co., Detroit, Mich.

Tenders

Toronto, Ont.—The Board of Control have called for tenders for a quantity of 36 inch cast iron pipe, tenders to be in by April 15. H. C. Hocken, mayor.

Winnipeg, Man.—Tenders addressed to the Chairman, Board of Control, will be received up to May 15th, for the manufacture, delivery and erection in the Generating Station at Point duBois of two 3-phase generators, for direct connection to double reaction turbines, and for spare parts for same. M. Peterson, Secretary.

Montreal, Que.—The Board of Control will call for tenders for the construction of the underground conduit in St. Catherine street between Papineau avenue and Guy street. The specifications and plans have been prepared by the Electric Service Commission and they require the removal of all overhead wires, save those required for the actual operation of trolley cars, into the municipal conduits. Tenders are to be submitted by April 25.

Simcoe, Ont.—Tenders will be received by the Town Clerk until April 23rd, for the following material: Contract A—Laying main sewer and sewage force main. D.—Furnishing cast iron pipes. G.—Sewage pumping machinery. P.—Sewage pumping station. S.—The sewer pipes. X.—Sewage disposal works. Plans and specifications may be seen at the office of the Engineers, Toronto, or at the Town Hall, Simcoe, Ont. C. Gibson, Mayor. W. C. McCall, Town Clerk. Chipman & Power, Engineers, Toronto.

Montreal, Que.—Sealed proposals will be received at the office of the Board of commissioners, city hall, Montreal, up till April 15, for the furnishing and erecting, at the Low Level Pumping Station of the Montreal Water Works, two water tube boilers, with all their fittings and appurtenances complete; the whole in accordance with the general specifications and plans to be seen and examined at the office of the Engineer Superintendent of Water Works, City Hall, Montreal. L. N. Senecal, Secretary.

Contracts Awarded

Winnipeg, Man.—Thos. Kelley & Sons have secured the contract for a $34,000 sewer, 2,550 feet long, from this city.

Calgary, Alta.—The City Council have awarded the contract for the supply of fire apparatus to the Webb Company. Their tender price was $31,175.

Hamilton, Ont.—The contract has been let for the electric pumping station to cost $20,000, planned by Board of Control. General contractor and mason, Geo. E. Mills, 614 King street east.

St. Thomas, Ont.—The Hope Engineering and Supply Co., of Pittsburg, Pa., has been awarded the contract for the extension of the 12-inch pipe line of the Dominion Natural Gas Co.

Sutherland, Sask.—Contract for the sewage disposal tanks costing $45,000 has gone to Edmund T. Sykes of Neepawa, Man. J. Browley, of Fernie, B.C., has secured contract for sewers, manholes, etc.

Niagara Falls, Ont.—The contract for the supply of cast iron pipe for all the work during the year has been awarded the United States Pipe Company, of Buffalo. The contract for service pipes was given Gainer Bros.

Montreal, Que.—The city has awarded a contract to Messrs. Laurin & Leech for the laying of a new 36 inch steel water-pipe from Point St. Charles to the McTavish St. reservoir. About $100,000 will be expended on this work.

Montreal, Que.—The city of Moose Jaw has awarded the contract for supplying a new 1,500 k.w. turbo-generator to the Sieman's Company of Canada, Limited. The machine will be run at 3,600 r.p.m., and will be suitable for 3-phase, 60 cycle circuit.

Edmonton, Alta.—The Waller-Robertson Co. have been awarded the contract for supplying the city with a 4,000 k.w. turbo generator. The turbine is to be capable of driving an electric generator giving an output of 4,000 k.w. as the normal full load, and an overload of 25 per cent. for two and 50 per cent. for one hour respectively.

New Westminster, B.C.—Contracts for material and equipment to be used in connection with the harbor work, aggregating in value over $130,000 have been let as follows: Dredge hull, Star Shipyard Company, $8,988.75; 150 horsepower electric hoist, Allis-Chalmers-Bullock, $6,569, with discounts; 150 horse power electric hoist; Taylor & Young, Vancouver, $5,142.55, with discounts; tug Hero, without boiler, Thomas Appleton, $6,000; steam hoisting engine, Washington Iron Work, Seattle, $4,050; tubular boiler, Vulcan Iron Works, $2,900; piling for quay front, Waugh, Meisener and Bailey, Vancouver, over $100,000.

Trade Gossip

The Electrical Repair Co., 122 Wellington St., W., Toronto, have opened up a new plant at this address, equipped with the latest machinery for repairing electrical apparatus. A. N. Smith and J. W. Chipperfield are the proprietors.

D. G. C. Valve Co., of Canada, Ltd., incorporated at Ottawa, as manufacturers of machinery and steam specialties. Capital $25,000. Incorporators:—T. S. Owens, J. Christopher, B. Walsh, H. McIntyre, Marcella McNulty, and Agatha Clifford, all of Montreal.

The Siemens Company of Canada, have received the order for a 1,500 K.W. turbo-generator for the city of Moose Jaw, Sask. The machine will run at 3,600 r.p.m. and be suitable for a 3-phase 60-cycle circuit. The generator will be direct coupled to a Willans & Robinson steam turbine.

Personal

A. E. Armitage has been appointed superintendent of works for Sutherland, Sask.

J. G. Glassco has been appointed manager of Winnipeg light and power department at a salary of $4,800.

R. H. Thomson and City Engineer Rust, of Victoria, have been named to investigate the Greater Vancouver sewerage proposals on behalf of the provincial government.

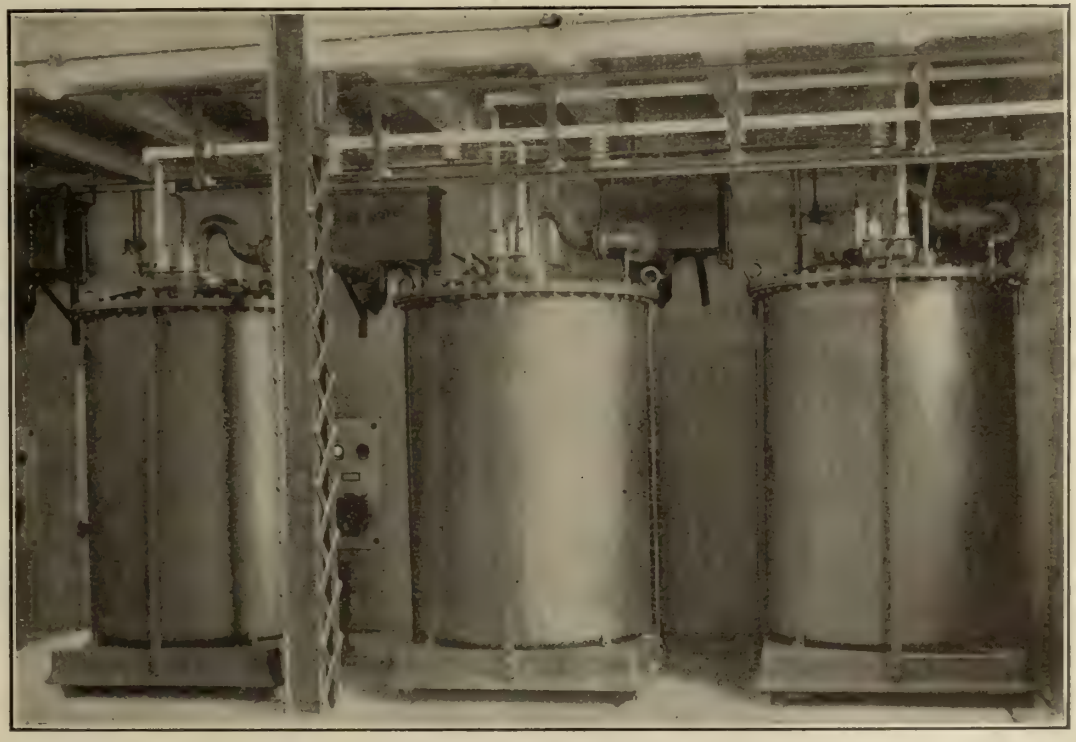
H. R. Parsons, C. E., late assistant city engineer, Ottawa, has been appointed city engineer of Peterborough at a salary of $2,500. The services of T. A. S. Hay, the present incumbent, will be retained at an advanced salary.

SIEMENS BROS. DYNAMO WORKS | SIEMENS BROS. & CO.

SIEMENS

SIEMENS - SCHUCKERTWERKE | SIEMENS & HALSKE

SIEMENS



THREE OF SEVEN 750 K.V.A. 22,000 VOLT, SINGLE PHASE, OIL INSULATED WATER COOLED TRANSFORMERS, SUPPLIED AND INSTALLED FOR THE CITY OF PORT ARTHUR.

Four of the above were a repeat order after the first bank had been in successful operation for eighteen months.

We also supplied the whole of the switching apparatus, lightning arresters and two 750 h.p. motor generator sets.

Attention is especially drawn to the expansion vessels connected by a pipe to the top of the transformer case. Our transformers are completely filled with oil including this connecting pipe, and part of the expansion vessel, expansion and contraction of the oil taking place in the latter.

By means of the peculiar shape of the connecting pipe the hot oil by the time it rises to the expansion vessel is sufficiently cool so that no hot oil comes in contact with the air, and no moisture can enter the transformer itself. This arrangement also keeps the oil in perfect condition and prolongs the life of the transformer.

Siemens Company of Canada, Limited

HEAD OFFICE:

Transportation Building - MONTREAL

BRANCH OFFICES:

STANDARD BANK BUILDING
TORONTO

McARTHUR BUILDING
WINNIPEG

L. J. Cudbrid has been appointed chief engineer at the City Hall, Toronto, to succeed the late Mr. James Bannan. Mr. Cudbrid has had experience on Atlantic liners, and holds a British Board of Trade certificate. He has been with the city a year and a half.

Mellis Ferguson, city engineer of Guelph, Ont., has placed his resignation in the hands of the Public Works and Sewerage Commission. It is understood that he will likely receive the appointment of city engineer at St. Thomas. Assistant City Engineer Holland will take his place temporarily.

Arthur Skidmore, who for the past ten years has been associated with the motive power department of the G. T. R. at Stratford, has been promoted to the position of chief engineer of the steam electric power plant in connection with the company's shops there. **H. Westwood**, formerly of the Waterloo Mfg. Co., has been appointed assistant engineer.

E. B. Blackwell has been elected managing director of the Canadian Willamette Co., Ltd., Vancouver, B.C. This company will manufacture an engine, which will be a duplicate of that made by the Willamette Iron & Steel Works, Portland, Ore. Mr. Blackwell has been selling agent of the Willamette Iron & Steel Works for the past seven years.

W. L. Richardson, for the past eight years superintendent of manual training in the public schools of Toronto, has been offered and has accepted the position of director of industrial education for the city of Edmonton, Alberta. Mr. Richardson will receive a salary of $3,000 in his new position, an increase of $600 over the salary he received in Toronto.

J. J. Conlin, formerly with the R. & O. Nav. Co., Ross & Greig, and The Garth Co., is now president and manager of the General Manufacturers Agencies, Ltd., 515 New Birks Building, Montreal. His firm are Canadian agents for Kieley & Mueller high grade steam specialties; the thermograde system of heat regulation; the Van Auken system of vacuum heating; the national system of automatic temperature control; Benj. F. Kelley & Son, heaters; and the Massachusetts Fan Co. They also handle The Shone system of sewerage ejectors, steam power pumps, filtering systems, sanitary individual washbowls, metal lockers, racks and steel tanks for all purposes.

Frank C. Askwith, who has been recommended by the Ottawa Board of Control for the position of assistant city engineer, has been connected with the city engineer's department for the last five years. He is the son of John E. Askwith, Ottawa deputy police magistrate, and was born in Chatham twenty-nine years ago. He worked two years for Fetherstonhaugh & Co., patent engineers, and in 1903 and 1904 was connected with the Grand Trunk Pacific Railway engineering staff, doing preliminary, location and office work in Saskatchewan and Manitoba. In 1905 he was with the Library Bureau of Canada, and for the following two years was connected with the irrigation department of the C. P. R. at Calgary. He joined the city engineer's department in 1908, and for the last three years has been roadway engineer. He has been acting engineer since December 20, and has given every satisfaction.

Obituary

James Grainger, a stationary engineer, died at his home, 1995 Davenport Road, West Toronto, April 4. He was born in Staffordshire, England.

James Bannan, chief engineer at the Toronto City Hall, died on Wednesday, April 2, after an illness of several months. The deceased had been in the city's employ for about twelve years.

Catalogues

Bruce Peebles & Co., Ltd., engineers, Edinburgh, Scotland, have a sterling reputation across the Atlantic as makers of alternating current motors. A bulletin recently sent to this office, dealing with induction motors is a veritable text book on the subject. It is a bulletin de luxe, dealing with every feature of the subject. Considerable technical data is to be found at the back of the book.

"A Little Journey to the Home of the Economy Turbine," written by Elbert Hubbard as the result of his visit to the works of the Kerr Turbine Co., Wellsville, N.Y., includes an interesting discussion of steam economy from the time of James Watt to the present. Mr. Hubbard has displayed such unusual ability in making interesting reading of a subject generally termed "dry," that when one engineer reads this booklet, he wants everybody in the plant to read it. The Kerr Turbine Company will send a copy on request.

HYDRO-ELECTRIC CONTRACTS.

WITHIN one month work will be started upon the extension of the Hydro Electric transmission line from St. Thomas to Windsor. The Hydro Electric Commission have awarded contracts amounting to approximately three-quarters of a million dollars for high tension lines and equipment, and the first of this material, the footings, will be delivered in four weeks, according to the expectations of Hon. Adam Beck.

A striking fact in connection with the awarding of the tenders is the fact that Canadian firms won out against foreign competitors in every case. The Canadian Bridge Co., of Walkerville, which supplied the towers for the Niagara line, has been awarded the contract for towers and footings. The Canadian Porcelain Co. will supply all the insulators, this being the first time they have been manufactured in Canada. Galt Malleable Iron Co. has been given the contract for the malleable iron clamps, the Canadian Westinghouse Co., of Hamilton, the contract for the electrical equipment, and W. H. Dunne, of Toronto, the contract for the pressed steel clamps.

Work will be started at four or five points along the line between St. Thomas, Chatham and Windsor, and Hon. Mr. Beck hopes to be in a position to supply Chatham and Windsor with power in a year.

LARGE CONTRACT CLOSED FOR HYDRO DEVELOPMENT.

ONE of the largest construction and engineering contracts of the year was closed on April 10, when the directors of the Cedar Rapids Power & Manufacturing Co., a subsidiary of the Montreal Light, Heat & Power Co., let out work in connection with the new Hydro-electric deevlopment, amounting to over $3,000,000.

The firm to secure the contract is Fraser, Brace & Co., of New York. Its undertaking will consist in taking up the work where the construction staff of the Cedar Rapids Co. left off, complete the canal and build the power house substructure. The installation under the contract just signed will be 100,000 horsepower, and the work must be completed by October, 1914. The terms of the contract are on a unit price basis, and the estimated value of the work is in excess of $3,000,000. The contract is one altogether apart from the machinery to be installed, tenders for which are pending.

The contract was signed on behalf of the company by Mr. Howard Murray, vice-president of the Cedar Rapids Co., and Mr. J. S. Norris, the secretary. Mr. Fraser, one of the signing contractors, is a Canadian by birth, and a graduate of McGill University.

AGENTS WANTED

LIBERAL COMMISSIONS TO DEALERS AND others handling Vulcan Soot Cleaners; applied to all types of boilers. Vulcan Tube Cleaning Systems, Limited, 42 Craig St. West, Montreal. (4tf)

LIBERTY BOILER TUBE CLEANERS

ARE THE

BEST POSSIBLE INSURANCE

AGAINST BOILER ROOM ACCIDENTS. Even a light coating of scale on the tube prevents the water from coming in contact with the metal, and the intense heat to which boiler tubes are subjected burns out the metal and an explosion is liable to happen, which frequently results in the loss of life.

LIBERTY CLEANERS are not only a safeguard against accidents of this nature, but are a **remunerative investment**. They will save in fuel their purchase price every month.

If you have been experimenting with other types of cleaners which have failed to make good, do not put the **Liberty** in the same class, but let us send you one on trial, to prove their superiority and show you what a **real Cleaner** can do.

Write For Catalog

Liberty Manufacturing Company

6904 Susquehanna Street **PITTSBURGH, PA.**

Canadian Representatives:
Williams & Wilson, Ltd., Montreal. A. R. Williams Machinery Co., Toronto and Winnipeg.

T is
W hat
I s
N eeded

A six-hour catch of fish, leaves, etc., made by one basket of a Twin Strainer.

S uch
T roublesome
R ubbish
A bounds
I n
N early
E very
R iver or
S tream

to protect every plant that draws its water supply from lakes, ponds or rivers.

and the only convenient and efficient way to remove it from your water supply is with a Twin Strainer.

The TWIN STRAINER has two straining baskets and is made so that either one of the baskets may be cut out of the line at any time for cleaning, by simply shifting two valves.

If you are not acquainted with the Twin Strainer write for our catalog. It's ready for you.

ELLIOTT COMPANY

6902 Susquehanna Street, **PITTSBURGH, PA.**

CANADIAN REPRESENTATIVES;
Williams & Wilson, Ltd., Montreal. A. R. Williams Machinery Co., Ltd., Toronto and Winnipeg.

The advertiser would like to know where you saw his advertisement—tell him.

New Incorporations

The Gray Donald General Engineering Co., Ltd., was recently incorporated at Victoria, B.C.

The John Inglis Co., Ltd., incorporated at Ottawa as manufacturers of engines, boilers, etc., in Toronto. Capital $1,000,000. Incorporators:—E. A. J. Case, J. B. Taylor, C. G. Lynch, H. E. Wallace and L. W. Wood, all of Toronto, Ont

Brunelle Furnace & Boiler Co., incorporated at Ottawa, capital $100,000, to manufacture boilers at Three Rivers, Que.: Incorporators, J. A. Jutras, Johnny Boivin, Wilfred Descoteaux, J. B. Godbout, Three Rivers, Que.; A. Heroux, and Hercule Descoteaux, of Yamachiche, Que.

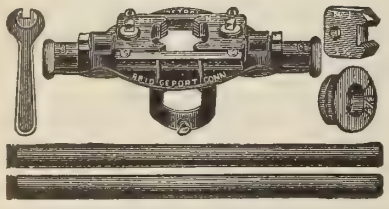
McDonald Hydro-Electric Heating Co., Ltd., incorporated at Ottawa, to provide power plants, capital $1,000,000: Incorporators, J. D. McDonald, R. Watson DeMorest, E. Hamilton Low, of Sudbury, Ont., R. McConnell, J. Beaton Watson, W. Clark Perkins, and Angus W. Fraser, of Ottawa, Ont.

The Northern Tire & Rubber Co., Ltd. incorporated at Toronto, to manufacture all kinds of rubber articles; capital $160,000. Incorporators, T. A. Fleming, C. S. Fenton & A. G. Roberts, all of Cleveland, Ohio, and W. L. Nelson and J. H. Cole, both of Owen Sound, Ont., and J. W. Albaugh of Canton, Ohio, and C. Price, of New Berlin, Ohio.

Catalogues

Engineering Works of Canada, Ltd., Montreal., have favored us with a copy of their catalogue G. which clearly illustrates and describes the Alternating Current Generators built by the company under the "Societe Alsacienne" patents. The booklet is well gotten up and is embellished with excellent half-tone cuts, which illustrate some of the very heavy work turned out by the firm.

Bulletin G-1 "The Lagonda Reseating Machine" is the title of a 6 x 9 pamphlet recently issued by the Lagonda Mfg. Co., of Springfield, Ohio. It describes the construction and use of their portable carborundum wheel for removing soot and scale from the faces of caps and tube ends on boilers. These wheels are driven by either electric, water, steam or air motors and the photographs showing actual cleaning operations greatly assist in understanding the value of this reseating machine for making a steam and water tight joint when replacing the caps on B. & W. and similar boilers after having been removed for tube cleaning purposes. Copies may be had by addressing the Company as above.



GENUINE
ARMSTRONG STOCKS
AND DIES
FOR CUTTING PIPE & BOLTS
ARE THE BEST.

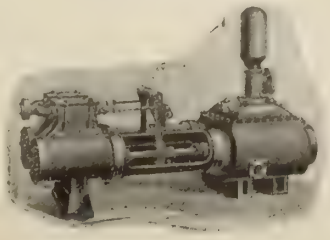
PIPE MACHINES
PIPE CUTTERS
HINGED PIPE VISES
RATCHET ATTACHMENTS

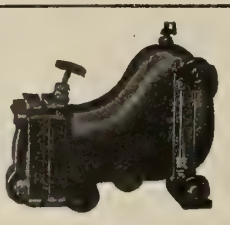
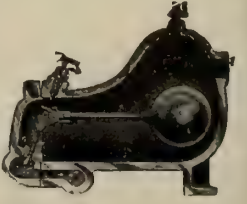
Manufactured by
THE ARMSTRONG MFG. CO.
298 Knowlton St.
BRIDGEPORT, CONN.
NEW YORK CHICAGO
Catalog mailed on request

HAVE YOU TRIED
MONCRIEFF'S "UNIFIC" WATER GAUGE GLASSES?
They never corrode. They last longer. They defy competition.
For full information apply to our Canadian Representative,
W. J. WALL, 134-136 Bleury St., Montreal

MILL SUPPLIES
Lubricating Oils and Greases
Belting—all descriptions
Dodge Split Pulleys
NEAREST SHIPPERS TO QUEBEC DISTRICT
Prompt Attentian and Immediate Delivery.
F. H. ANDREWS & SON
253 St. Paul Street - Quebec

THE CANADIAN TURBINE WATER WHEEL
CONSERVE THE WATER POWERS
TRADE MARK.
Chas. Barber & Sons
Meaford : Ontario
WATER POWER EQUIPMENT ONLY
Write for Catalogue

STEAM and POWER PUMPS, CONDENSERS, TRAVELLING CRANES

The SMART-TURNER MACHINE CO., Limited
Hamilton Canada


McDANIEL IMPROVED STEAM TRAP
FOR HIGH OR LOW PRESSURE.
Steam can't blow through. They have large discharge valves and cannot be flooded from sudden flushes of water.
MAY WE SEND ONE FOR TRIAL?
Reducing Valves, Pump Governors, Relief Valves, Exhaust Pipe Heads, Ejectors and Steam Separators. SEND FOR CATALOGUE.
THE GARTH COMPANY
26 Craig St. MONTREAL, CAN.
WATSON & McDANIEL CO.,
No. 146 N. 7th St. PHILADELPHIA, Pa.


Classified Advertisements.

Those who wish to sell or buy a business, obtain competent help, connect with satisfactory positions or secure aid in starting new enterprises, should not fail to use the Want Ad. Page of The Power House.

Do you want to sell or buy a second hand engine or any other equipment, let The Power House pick out a seller or buyer for you.

There is always someone looking for just such proposition as you have to offer.

RATES (payable in advance):—2c. per word first insertion, 1c. per word subsequent insertion, 5c additional each insertion when Box Number is required. Each figure counts as one word.

SALESMEN WANTED

LAKE ERIE BOILER COMPOUND CO. REquire a few first-class representatives to sell their well-known compound. Liberal commission paid to live men, and exclusive territory. Write at once, giving references, 11 Colborne St., Toronto. (tf)

WANTED — EVERY POWER HOUSE IN Canada to remember that C. E. Shedrick, Craig Street West, Montreal, is still repairing measuring instruments, both switchboard and portable. Twenty-five years' experience in repairing all kinds and makes on the market. Integrating meters repaired, tested and sealed, and returned on quick time.

FOR SALE

ONE KEIGHLEY GAS ENGINE, 45 H.P. IN first-class shape. Reason for selling: Equipping new plant with Electric Power. This engine can be seen running at any time at present works. The Thomson Monument Co., 1194 Yonge St., Toronto.

BELTING FOR SALE—800,000 FEET OF best quality leather, rubber, hair and canvas belting, bought from bankrupt manufacturers at 25% to 75% less than the regular value. Also a large quantity of slightly used belting, piping, chains, rails, pulleys, hangers, cotton waste, etc., at very low prices. Send for catalogue. Imperial Belting and Supply Co., 5 Queen Street, Montreal.

WANTED

WANTED—CANADIAN REPRESENTATIVE to distribute ice making and refrigerating machinery, internal combustion engines of all kinds, and special machinery of any kind built to order. Cleveland Ice Machine & Mfg. Co., Lorain, Ohio, U.S.A.

SITUATION WANTED

ENGINEER WANTED.

WANTED—CHIEF ENGINEER TO TAKE charge of power plant, capacity 800 horse power, steam and electric, in city in Ontario with population of 25,000. Good permanent position for first-class man. Apply by letter or in person to Mr. Samuel King, 13 Wellington Street East, Toronto, Ont.

MISCELLANEOUS

BECAUSE THE REMINGTON TYPEWRITer Company's Employment Department has earned the reputation among stenographers of filling the most desirable office positions, the result is that we place the most desirable class of office help. May we fill your stenographic vacancy? No fees. 144 Bay St., Toronto.

QUIT TAKING CHANCES ON YOUR ELECTRICAL REPAIRS

Look over your shop and send us that old MOTOR or DYNAMO that needs winding or repairing.

Tell us your electrical troubles. We fix anything — anywhere.

We do work from Rimouski to Winnipeg.

To-day is the day to write. Promptness our motto.

Absolute guarantee of satisfaction or money back.

What more do you want?

MEAD ELECTRIC CO., LIMITED

23 St. George St. Montreal, Que.

Convert Lost Power of Friction Into Useful Work by Using

Dixon's Flake Graphite

The standard lubricating graphite of the world, which wonderfully increases the efficiency of any oil or grease by forming upon the bearing surfaces a tough, practically frictionless coating of graphite which minimizes wear, increases power and multiplies the life of your machinery. Prove this—at our expense—by asking us for a sample and our book, "Graphite As A Lubricant," No. 222.

JOSEPH DIXON CRUCIBLE CO.

JERSEY CITY, NEW JERSEY

ESTABLISHED 1827

U.S. BARKEEPERS FRIEND METAL POLISH

USED AND ENDORSED BY THE LEADING DEALERS

SOLD ALL OVER THE WORLD

DON'T WASTE A LOT OF TIME DOPING OUT WHY A BLACK HEN LAYS A WHITE EGG

Get The Egg

"CAMEL HAIR" "CAMEL" BRAND BELTING

DON'T THINK IT IS WHAT IT ISN'T.

THE CAMEL HAIR BELT has been on the market for MANY YEARS, and yet many users think it is something new.

It has TWICE THE ENDURANCE of a leather belt under usual conditions and TEN TIMES the Endurance of a leather belt under un-usual conditions.

WHY DON'T YOU LEARN MORE ABOUT IT

For main driving and heavy work generally. Paper and pulp mills, steel plants, breweries, ice plants, cement mills, cotton mills, bleacheries, dye houses, tanneries, exposed drives, chemical works.

F. Reddaway & Co.

595 St. Paul Street

MONTREAL, QUE.

Sole Makers of

"CAMEL HAIR" "CAMEL" BRAND BELTING

(Beware of Imitations)

HINTS TO BUYERS

ALLIGATOR BELT LACING

FLEXIBLE STEEL

Makes Joints Quickly.

Only a Hammer Required.

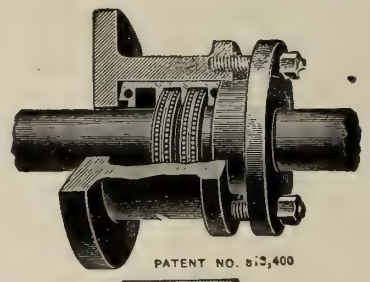
No Holes to Punch.

Forms the Strongest Part of The BELT.

Let Us Send One On Trial.

The Crescent Oil Company, Hamilton and Toronto, Ont

Stocks carried by—Sadler & Haworth, Montreal; Austen Bros., Halifax; P. A. Gouin, Three Rivers, P.Q.; J. S. Mitchell & Co., Sherbrooke, P.Q.; Great West Engine Packing Co., Winnipeg; F. H. Andrews & Son, Quebec, P.Q.; E. N. Jones, St. John, N.B.



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Why not Buy the Best, when in market for Packing?

HOLMES'

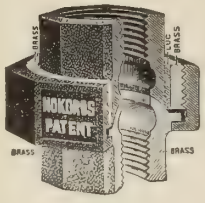
Metallic Packing

is Guaranteed 3 years

Lasts many times longer. 30 days trial. Less oil. No cutting. Easily applied to any Steam Engine, Air Compressor or Gas Engine. Satisfaction or no pay. Write us.

Holmes Metallic Packing Co., Wilkes-Barre, Pa.

The Nokoros Patent Union



The only union made absolutely Non-Corrosive. Brass to iron in all contact points. Ball joint; Octagon ends, any wrench can be used. Adapted for heavy service. Every union air tested at factory. Send for circular B, describing the above and other fittings made by

G Tested & uarantee D

OTTERVILLE MFG. CO., LIMITED
OTTERVILLE, ONTARIO

Notice to Stationary Engineers

Everyone operating a Stationary Steam Plant of 50 h.p. or over, in the Province of Ontario, must hold a Certificate from this Board. Anyone operating such a plant without a Certificate is liable to the penalties set forth in the Stationary Engineers' Act

HON. J. S. DUFF,
Minister of Agriculture.

W. C. McGHIE,
Chairman of Board,
Parliament Buildings, Toronto

Mueller Pressure Reducing and Regulating Valves

Give accurate and absolute control of pressures of water, steam, air, gas, oil, carbonic and acetylene gases—in fact, all kinds of pressures. Their efficiency is firmly established. Manufactured under Canadian patent No. 127,566. Address:

DOHERTY MFG. CO., Limited
Sarnia - Ontario

Manufacturer for The H. MUELLER MFG. CO., Decatur, Ill., and New York City.

EVERYTHING FOR

Engineers and Draughtsmen

ARTISTS' AND DRAUGHTSMENS' MATERIALS
THE ART METROPOLE
241 YONGE STREET TORONTO

Faber's No. 368, Slide Rule, specially graduated for Electrical Computations.

WRITE FOR CATALOGUE.

THE ART METROPOLE
241 YONGE STREET, TORONTO

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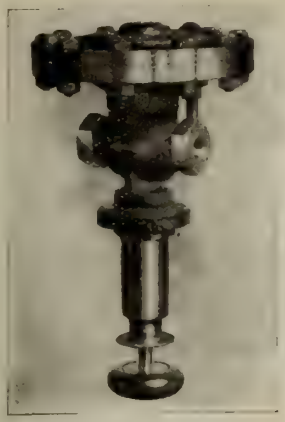

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Regulating Valves

are being used exclusively in many of the most prominent Rubber and Paper Plants, Hotels, Laundries, etc., simply because they regulate steam or air accurately and continuously.

Sold on 30 day trial — Your dealer can supply you promptly.

Write for Catalogue K-C.

THE OHIO BRASS CO.
Mansfield, OHIO

LUBRICATING OILS

Canadian Oil Companies, Limited

TORONTO MONTREAL ST. JOHN
HALIFAX WINNIPEG
REGINA CALGARY
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"Monowatt" Tungsten
Incandescent Lamps
and
Carbon 3 1-2 "Watt"
Incandescent Lamps

First quality lamps in stock in every candle power at lowest prices.

G. LEWIS
Sole Distributor
P.O. Box 1513 14 St. Sacrament St.
MONTREAL

Mechanical Drawing
By Ervin Kenison, S.B.

Instructor in Mechanical Drawing, Massachusetts Institute of Technology

176 pp., 140 illus. Cloth binding. Gives a course of practical instruction in the art of Mechanical Drawing, based on methods that have stood the test of years of experience. Includes orthographic, isometric and oblique projections, shade lines, intersections and developments, lettering, etc., with abundant exercises and plates,

Price, $1.00

MacLean Publishing Co.
Technical Book Dept.
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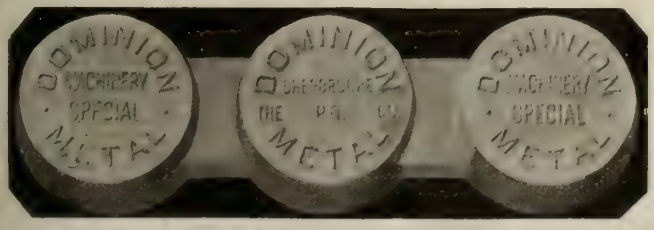
PRICHARD'S BABBITTS
ARE
SOLD ON MERIT

They are designed to meet modern machinery conditions.



They are all COPPER-TIN-TOUGHENED, are DROSS FREE, and are made from the purest Metals obtainable.

WE want you to know the following of our Brands:

PRICHARD'S EAGLE GENUINE
PRICHARD'S MACHINERY SPECIAL
PRICHARD'S METALLIC PACKING
PRICHARD'S MAPLE LEAF

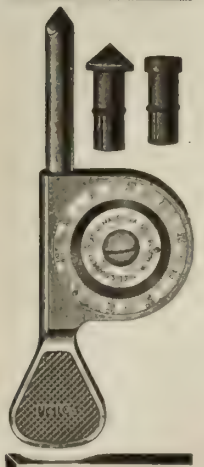
They represent the best that can be made, for **High Speed, Heavy Pressure,** or **General Purpose** use. We make Babbitt Metal ONLY—and we make it specially for any place in which it can properly be used.

Our PRICES ARE ROCK BOTTOM, and are named F.O.B. your nearest RAILWAY STATION. Descriptive Catalogue and Prices on request.

MANUFACTURED BY
The DOMINION METAL COMPANY
N. B. PRICHARD, Prop.
SHERBROOKE, P. Q.

Montreal Selling Agents
Foss & Hill Machinery Co., 344 St. James Street, Montreal

Take the Pulse of Your Power Plant



The engine is the heart of your plant. Be sure that it is working at the proper speed. You can tell exactly with a

STARRETT SPEED INDICATOR

It registers any speed without heating of the parts. The movements are enclosed like a watch. This indicator is equally good for motors, gas engines, shafting, or any revolving machine part. Rubber tips for centered or pointed shafts. Get the Starrett Catalogue 19 CD. It shows other tools for the engineer.

The L. S. Starrett Co.
Athol, Mass.

NEW YORK 150 Chambers Street
LONDON 36 & 37 Upper Thames Street, E.C.
CHICAGO 17 No. Jefferson Street
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Machine Banded Wood Stave

WATERPIPES and TANKS

For city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited

P.O. Box 563 Vancouver, B.C

WRITE FOR CATALOGUE

Full Particulars and Estimates Furnished

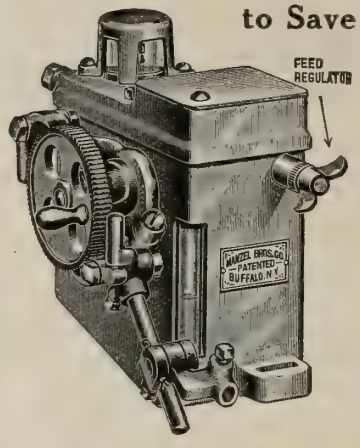
We Guarantee The

MANZEL

AUTOMATIC FORCE AND SIGHT FEED

Oil Pump

to Save 30% of Your Oil



Let us send you one on approval. If at the end of 30 days you find that it should not save as we guarantee, you can send it back at our expense and there will be no charge against you. With this Pump, Oil is fed into the Cylinder **regularly** and **positively** all the time—no matter how slow the engine runs, what pressure of steam is carried, how high or low the temperature.

You cannot afford to overlook this trial offer. Write to-day.

THE TWIN CITY OIL COMPANY

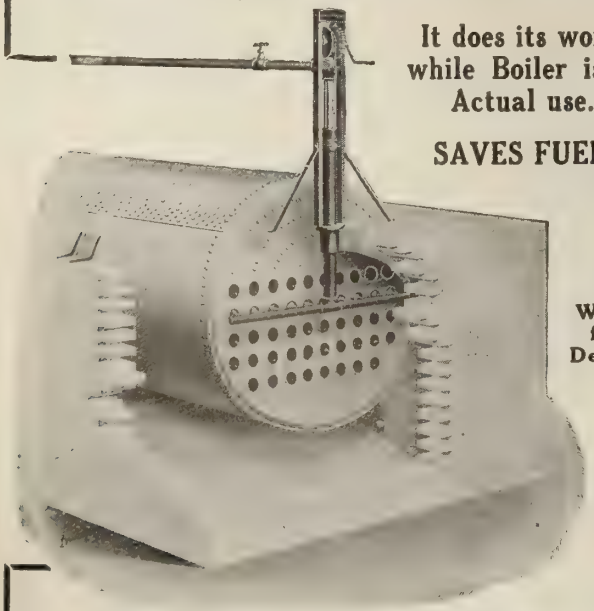
General Agents for Canada

BERLIN, - - ONTARIO

MANZEL BROTHERS COMPANY, BUFFALO, N.Y.

You can clean your Boiler Tubes at a Saving of much Time and Labor with

"The Henry" Steam Flue Cleaner



It does its work while Boiler is in Actual use.

SAVES FUEL!

Write for Details

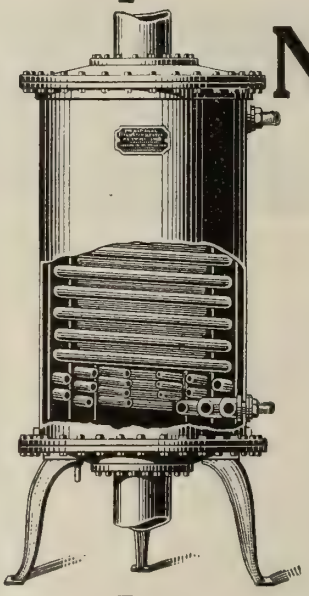
THE STEAM APPLIANCE CO.

MILWAUKEE, WISCONSIN.

CANADA SALES CO., Donalda Bldg., Winnipeg

Pure, Clean, Hot Water

SAVES FUEL MAKES THE BOILERS LAST LONGER



NATIONAL

FEED WATER

HEATERS

Utilize heat in exhaust steam—save fuel.

Coils, not straight tubes —no leaks.

No back Pressure, No Oil.

Send for Catalog No. 1

The National Pipe Bending Co.

91 Lloyd St., New Haven, Conn.

46-16

The advertiser would like to know where you saw his advertisement—tell him.

GRAPHITOL

Pat. and Trade Mark Reg'd.

"Graphitol" is a graphite powder and liquid which, in combination, embody the cement principle applied to the production of a lubricated bearing material of hardness and durability.

No heating is required, and the mixture sets in a reasonable length of time.

Graphitol bearings require less lubricant, as the material is to a high degree self-lubricating, in addition to which it absorbs oil and feeds it evenly over the entire bearing surface without waste.

The heat resisting properties of graphite are well known.

Free illustrated pamphlet will be sent upon request to

British Pacific Supply Company

F. C. Winkler, Manager,

VICTORIA, B. C.

MAKERS OF GRAPHITOL.

Scale Free Boiler Tubes, Boiler Efficiency and Fuel Economy

Are Always the Result of Using

WALKER'S ELECTRIC BOILER COMPOUND

High Grade Oils

Regal Valve Oil
Red Star Cylinder Oil
Monarch Cylinder Oil
Superior Engine Oil
Electric Engine Oil
Vulcan Machine Oil
Heavy Red Machine Oil
Brush Dynamo Oil
Gas Engine Oil and all Engine Supplies

A very small quantity used regularly will keep your boiler tubes **absolutely** clean, and prevent pitting, corrosion, foaming, etc.

The ingredients used in making this compound are harmless to metal; therefore it cannot injure tubes or fittings.

Give it a trial and you will always use it.

The Electric Boiler Compound COMPANY, LIMITED

Guelph, - - Ontario

Schneider & Helmecke, Magdeburg Germany

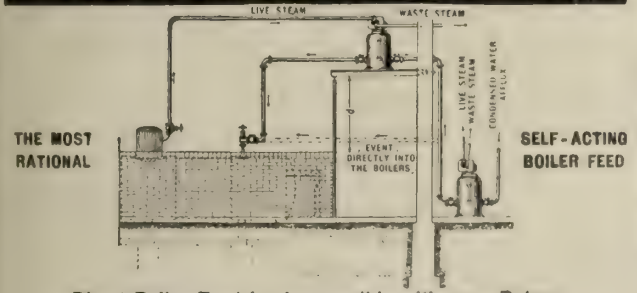
RETURN STEAM TRAP FOR FEEDING BACK HOT

Founded A.D. 1678 — JSt — Export

GREAT SAVING IN COALS AND WORKING EXPENSES.
INCREASED BOILER EFFICIENCY.
INCREASED LIFE OF BOILER.
MINIMUM OF BOILER INCRUSTATION.

Special Works for Steam Traps

CONDENSED WATER DIRECT TO BOILER, WITHOUT PUMP.



Direct Boiler Feed is also possible with one Return Steam Trap according to the situation.

Dominion Sugar Company, Ltd. We received your favour of the 5th inst. and noted its contents. To our great satisfaction we are able to inform you that your **Return Steam Traps,** are working excellently. We have now installed all **four,** which have worked faultlessly right away from the commencement. — **One** double Return Steam Trap suffices for conveying the condensed water from 6 Sperber drying apparatus directly back to the boilers. — *Since the Return Steam Traps were installed the feed pump for the boilers of the splitting-drying department has not been used.* — **The saving in coals is considerable,** since by aid of the Return Steam Traps we can now easily keep up full steam, **whereas previously we had constantly to force the boilers to the utmost.** After the experience gained with your condensed water Return Steam Traps we must admit, that no plant ought to be without the same. **The feed pump has always been a unisance to us.**
We leave it to your discretion to make whatever use of this you please.
Wallaceburg (Canada), Ont., Novbr. 22 nd, 1909.

The
Morehead Condenser Trap makes its own Vacuum

and PULLS the accumulated water and air out of your steam lines, insuring rapid circulation. Enables you to cut down your boiler pressure on direct heating systems.

Particularly adapted for use in connection with reduced pressure and Exhaust Steam Heating Systems, Dry Kilns, Dryers, Fan Stacks, Etc.

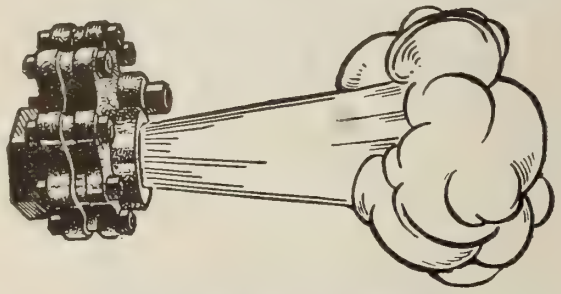
Write for Particulars and a Trial Trap.

Canadian Morehead Mfg. Co.

WOODSTOCK, ONT.

*The advertiser would like to know **where you saw his** advertisement—tell him.*

EVERLASTING
BLOW-OFF VALVES



IT NEVER LEAKS!

WRITE FOR PRICES

200,000 IN USE

Does your Boiler leak, Mr. Engineer?

How often do you blow it?

The "EVERLASTING" is the only perfect blow off valve on the market.

No stuffing box—requires no packing—is self-cleaning, and has a self-grinding seat—nothing to get out of order—What's the answer?

RELIABILITY—SIMPLICITY.

SOLD AND MANUFACTURED UNDER CANADIAN PATENTS BY

Engineering Specialties Company, 1080 King St., West, TORONTO

LIMITED

AGENTS

MONTREAL, QUE.
H. L. Peiler & Co.

ST. JOHN, N.B.
The A. R. Williams Mach. Co.

WINNIPEG, MAN.
The A. R. Williams Mach. Co.

CALGARY, ALTA.
P. D. McLaren Limited

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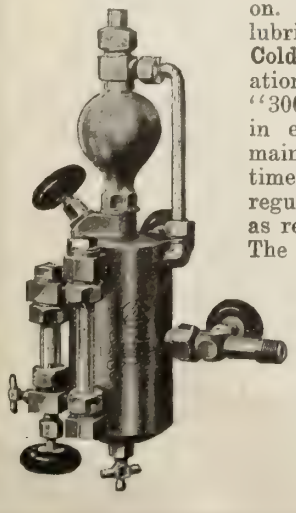
New Detroit Grease Lubricator

The new Detroit "300" Grease Lubricator feeds grease, non-fluid oils and similar lubricants evenly, efficiently and economically. It is much the same in construction as the Detroit Improved Standard Lubricator.

The heating chamber is of sufficient size to reduce all the lubricant in the reservoir to a thoroughly liquid condition immediately after steam is turned on. No time is lost waiting for the lubricator to warm up before feeding. **Cold drafts and** temperature variations cannot affect the Detroit "300" in any way. The oil or grease in every part of the lubricator is maintained in a fluid condition at all times, with an even rate of feed, fine regulation and maximum economy as results.



The "300" Grease Lubricator is only one of the new devices introduced by the Detroit Lubricator Company.

Detroit Lubricators have kept pace with every advance in mechanical practice. Whenever a new machine is brought out or a new condition arises, the Detroit Lubricator Company has designed immediately a lubricator for that service—if, indeed, the complete line did not already contain a device that would meet requirements.

Every Detroit Lubricator embodies all the improvements and refinements made possible by long experience in the sale and manufacture of lubricators and by careful study of over 1,250,000 lubricators in use on all kinds of engines all over the world. The Detroit is the world's standard of excellence in lubricating devices.

The big 232-page Detroit catalog tells all about the different kinds of lubricators and other Detroit products—gives complete instructions for installation, care and operation, and contains much valuable information on the general subject of lubrication.

Write for catalog G-58.

CANADIAN DETROIT LUBRICATOR COMPANY, LTD.

WALKERVILLE, ONTARIO

A Profitable Pointer For Power Plant Operators

Why do you suppose that thousands of power plant operators in all parts of the world use Dearborn Treatment to overcome boiler feed water troubles?

It Pays!

Why do you think that we are able to maintain one of the largest and best equipped of modern chemical laboratories, devoted solely to the study and correction of feed water problems?

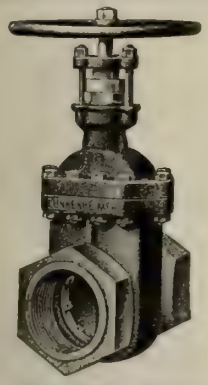
We make Good For Our Clients!

If our service pays other power plant operators, it will pay you. If we have made good for them, we can make good for you.

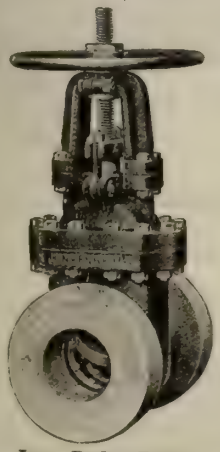
At any rate it's only good business for you to **investigate** any proposition which promises you big economies and big gains in operating efficiency, especially when the promises are backed up with records of results in thousands of cases. Send gallon sample of your boiler feed water, and let us make recommendations for your plant.

DEARBORN CHEMICAL COMPANY

McCormick Building, Chicago



Iron Body, Brass Mounted, Stationary Stem.



Iron Body, Brass Mounted, Rising Stem.

LUNKENHEIMER "VICTOR" GATE VALVES

This line of Gate Valves is the largest and most complete made. It consists of Medium and Extra Heavy **Brass Valves**; Standard, Medium, Heavy and Extra Heavy **Iron Body Brass Mounted Valves; "Puddled" Semi-steel and Cast Steel Valves.** All of these patterns are made in two styles—with **Stationary Stem** or with **Outside Screw** and **Yoke**, and in all standard sizes.

The high grade bronze composition used contains a large percentage of copper and tin; the Iron is hard and close-grained, and has a tensile strength of 25,000 pounds per square inch; the "Puddled" Semi-steel, for superheated steam, has a tensile strength of 35,000 pounds, and the Cast Steel, for extreme conditions of strain and superheat, has a tensile strength of nearly 80,000 pounds per square inch.

Lunkenheimer "Victor" Gate Valves are practically indestructible, inasmuch as all parts subjected to wear can easily be renewed, without necessitating their removal from the connecting pipe, and this includes the seats and disc.

The valves are double seated and will therefore take pressure from either side. They are absolutely tight, easily operated, and the stuffing-boxes can be packed under pressure when the valves are wide open.

Specify and insist upon securing genuine **Lunkenheimer make.** Do not accept substitutes—they are never as good as the genuine.

"MOST supply houses sell them—yours CAN—if they DONT or WONT tell US."

Write for Catalogue.

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Largest Manufacturers of High-grade Engineering Specialties in the world.

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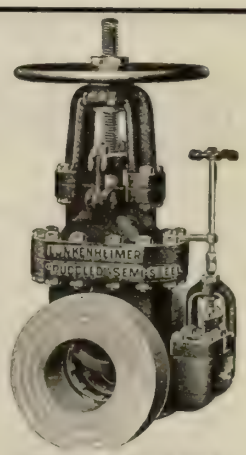
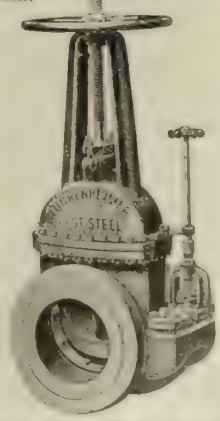


"Puddled" Semi-steel. With By-pass and Rising Stem.



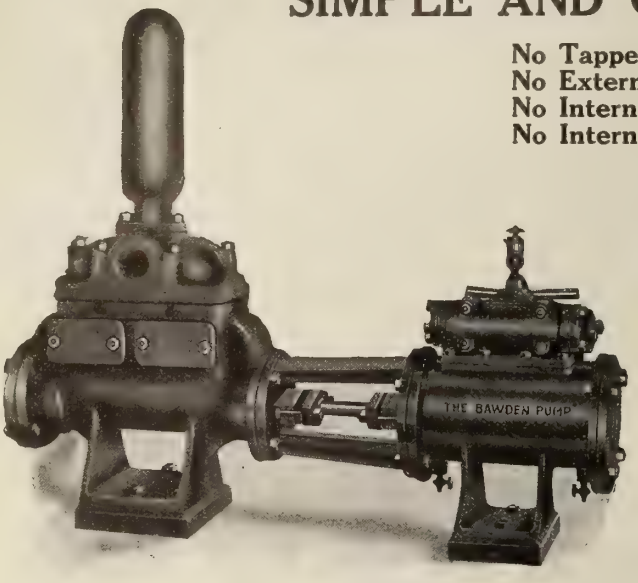
Cast Steel. With By-pass and Rising Stem.

The advertiser would like to know where you saw his advertisement—tell him.

"BAWDEN" STEAM PUMPS

MANUFACTURED UNDER ATTWOOD'S PATENTS

SIMPLE AND COMPOUND, For all Purposes



No Tappets.
No External Valve Gear, Levers or Springs.
No Internal Tubes.
No Internal Stuffing Glands.

"Bawden" Pumps are governed by piston valves which are controlled by the action of live steam only.
—Simplicity throughout.
—Guaranteed to make full stroke under constant or varying loads.
—Valves, latest improved steam balanced type.
—Greatest economy of steam consumption.
The Bawden Pump provides the simplest, most economical and reliable means for feeding high or low pressure boilers.
Flexibility of speed obtained without any mechanical adjustment.
Automatic cushioning of piston and valves ensures greatest safety in any emergency.

THE BAWDEN MACHINE CO., Ltd., Toronto, Can.

Marsh Steam Pump

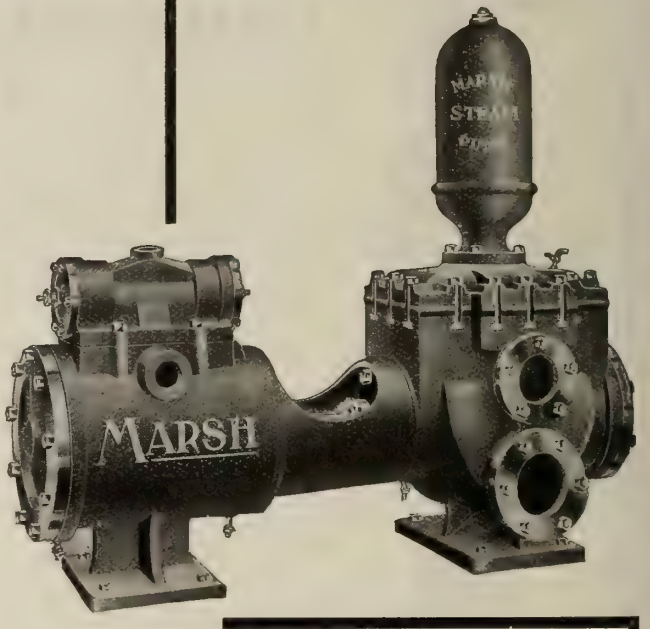
The Pump with the Self-governing Steam Valve

Note the extreme simplicity in construction and the absence of outside valve motion. There is practically nothing to get out of order. Nearly all the wearing parts are made of phosphor bronze instead of common brass, including piston rod, water cylinder lining and valve seats.

The steam valve is self-governing and admits only just enough steam to do the required work. The pump cannot short-stroke, race or pound under the most severe conditions.

115,000 in successful operation.

Ask for Catalog No. 18



American Steam Pump Company

BATTLE CREEK - - - MICH.

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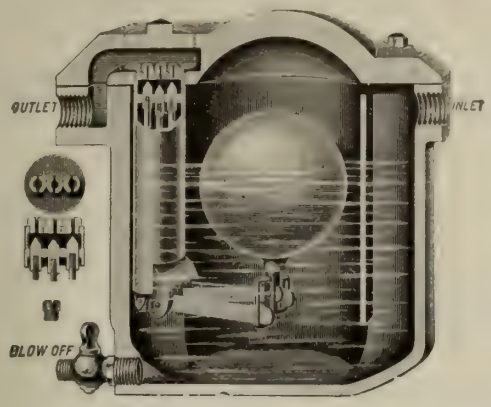

Wright
"Emergency" High Pressure Continual Flow Steam Trap

THREE VALVES

GREAT CAPACITY

Keeps the steam line automatically and continually drained of accumulating condensation.
Shipped subject to trial and return if results are not satisfactory.
Send for Catalog.

DARLING BROS., Limited
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Users Of The
"SIMS" Tubular Feed Water Heater
Find it Invaluable in their Boiler Room

It SAVES Fuel and Boilers

It's the **simplicity of construction, durability** and **extraordinary service-giving qualities** that account for the popularity of the **"Sims" Feed Water Heater.**

It is the result of the embodiment of the highest quality material, scientific methods and the work of experts.

All parts are thoroughly standardized by gauges and templates, and are subject to rigid inspection before leaving works.

We will be pleased to get you in touch with some users, so that you can profit by their experience.

Write for descriptive catalog.

THE SIMS COMPANY, Erie, Pa.

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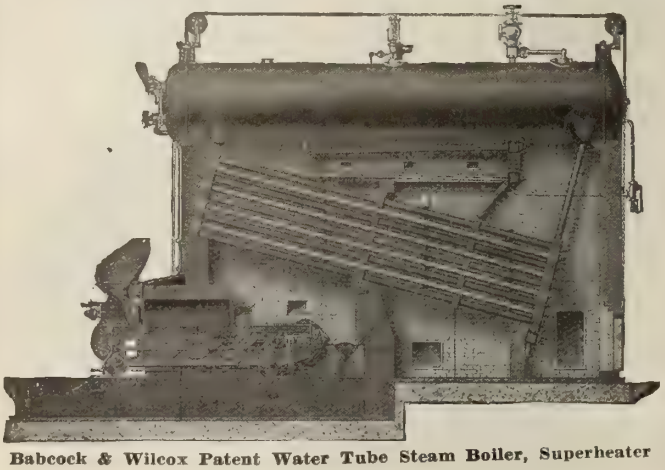
"B.&W." PATENT WATER TUBE STEAM BOILERS

With Furnaces for all Classes of Fuel or Waste Gases

HIGHEST ECONOMY, SAFETY, DURABILITY. OVER 10,000,000 H.P. IN USE



Babcock & Wilcox Patent Water Tube Steam Boiler, Superheater and Mechanical Stoker.

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and **ELECTRIC CRANES**

Our Book "STEAM" sent on request

HEAD OFFICE FOR CANADA - COLLEGE ST. (ST. HENRY), MONTREAL

TORONTO OFFICE, TRADERS BANK BUILDING

Power Plant Economy Must Begin In The Boiler Room

If the fuel loss is not checked **there**, your engine room results count for little. The little leaks and wastes that get your attention in the engine room are insignificant to the **preventable** waste under your boilers.

The Jones Underfeed Stoker

Is a big paying investment in the small plant. It is a **bigger** paying investment in the bigger plant.

Fuel saving from 10 to 25% interests you. That's what hundreds of Jones Stokers are doing to-day in plants like your own.

Your plant is not an exception. You need a Jones Stoker under every boiler you've got.

We will redesign your furnace, put in a **Jones Stoker** and **show** you. Write us!

How It Operates

Coal is placed in the hopper and automatically pushed into the green fuel bed under the fire, where it is subjected to a coking effect until it in its turn is forced to the top. Each charge of fuel causes a backward and upward movement that keeps the top of the fire, which is nearest the boiler, constantly agitated without opening fire doors. Air for combustion is admitted between the green fuel and the fire bed. The steam pressure itself automatically controls the fuel and air supply, proportioning them to each other and to varying loads in just the correct amount to obtain the most complete combustion possible from any grade of bituminous coal. As grates form no part of the Jones System, loss of fuel through grate bars is impossible. As combustion is commercially complete and air supply is correct, economy results and incidentally the smoke nuisance is effectively eliminated.

Jones Underfeed Stoker Co., Limited

National Trust Building :: TORONTO

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Darling Bros., Montreal.
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General Supply Co. of Canada, Ottawa
Hare Eng. Co., Toronto.
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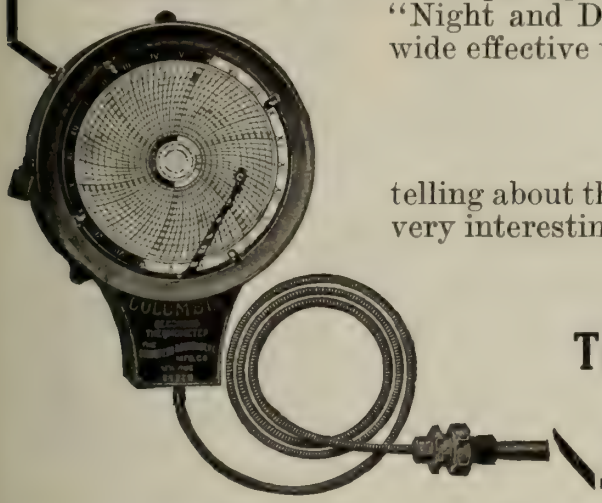

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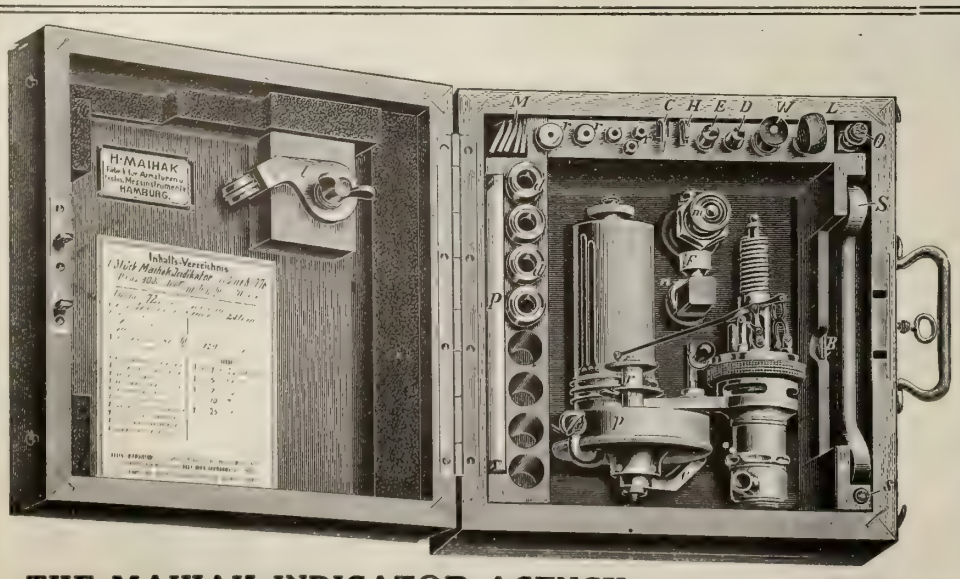

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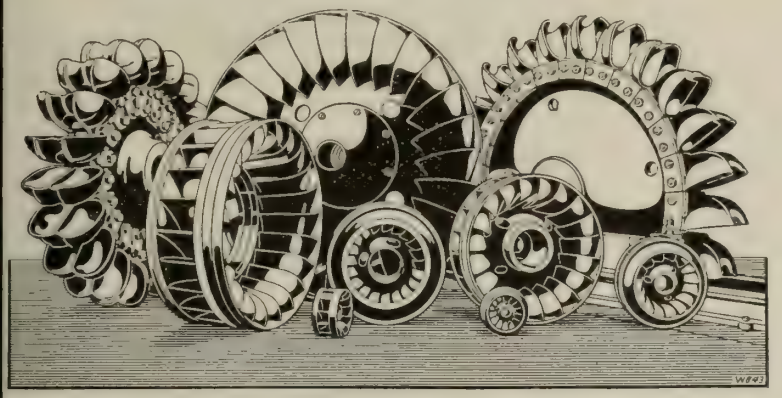

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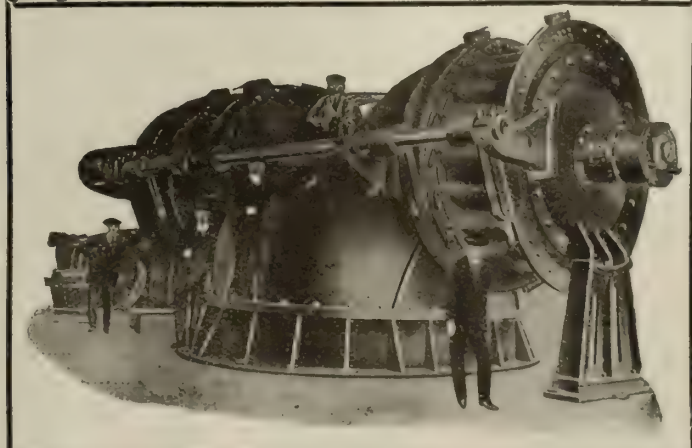

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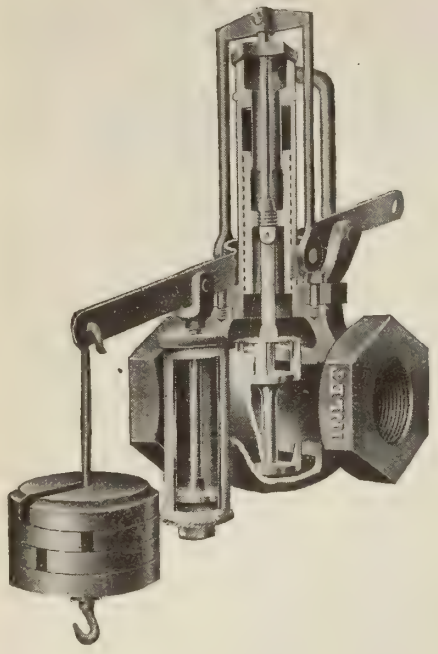

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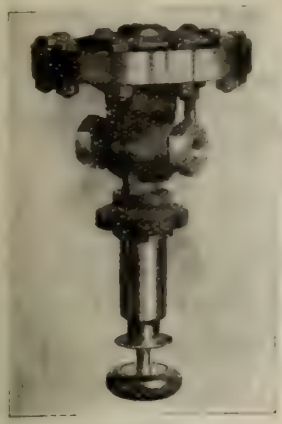

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They are all COPPER-TIN-TOUGHENED, are DROSS FREE, and are made from the purest Metals obtainable.

WE want you to know the following of our Brands:

PRICHARD'S EAGLE GENUINE
PRICHARD'S MACHINERY SPECIAL
PRICHARD'S METALLIC PACKING
PRICHARD'S MAPLE LEAF

They represent the best that can be made, for **High Speed, Heavy Pressure,** or **General Purpose** use. We make Babbitt Metal ONLY—and we make it specially for any place in which it can properly be used.

Our PRICES ARE ROCK BOTTOM, and are named F.O.B. your nearest RAILWAY STATION. Descriptive Catalogue and Prices on request.

MANUFACTURED BY

The DOMINION METAL COMPANY
N. B. PRICHARD, Prop.
SHERBROOKE, P. Q.

Montreal Selling Agents
Foss & Hill Machinery Co., 344 St. James Street, Montreal

Take the Pulse of Your Power Plant

The engine is the heart of your plant. Be sure that it is working at the proper speed. You can tell exactly with a

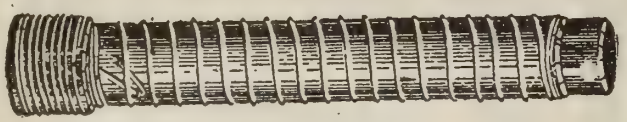
STARRETT SPEED INDICATOR

It registers any speed without heating of the parts. The movements are enclosed like a watch. This indicator is equally good for motors, gas engines, shafting, or any revolving machine part. Rubber tips for centered or pointed shafts. Get the Starrett Catalogue 19 CD. It shows other tools for the engineer.

The L. S. Starrett Co.
Athol, Mass.

NEW YORK 150 Chambers Street
LONDON 36 & 37 Upper Thames Street, E.C.
CHICAGO 17 No. Jefferson Street
42-138

The advertiser would like to know where you saw his advertisement—tell him.



Machine Banded Wood Stave

WATERPIPES and TANKS

For city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited

P.O. Box 563 Vancouver, B.C

WRITE FOR CATALOGUE

Full Particulars and Estimates Furnished

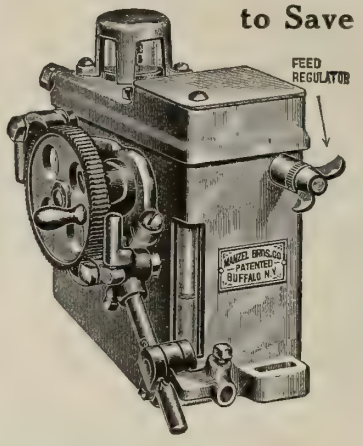
We Guarantee The

MANZEL

AUTOMATIC FORCE AND SIGHT FEED

Oil Pump

to Save 30% of Your Oil



Let us send you one on approval. If at the end of 30 days you find that it should not save as we guarantee, you can send it back at our expense and there will be no charge against you. With this Pump, Oil is fed into the Cylinder **regularly** and **positively** all the time—no matter how slow the engine runs, what pressure of steam is carried, how high or low the temperature.

You cannot afford to overlook this trial offer. Write to-day.

THE TWIN CITY OIL COMPANY

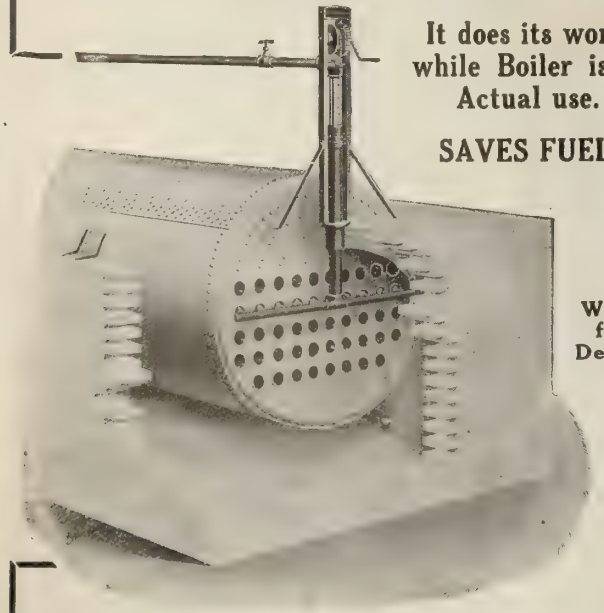
General Agents for Canada

BERLIN, - - ONTARIO

MANZEL BROTHERS COMPANY, BUFFALO, N.Y.

You can clean your Boiler Tubes at a Saving of much Time and Labor with

"The Henry" Steam Flue Cleaner



It does its work while Boiler is in Actual use.

SAVES FUEL!

Write for Details

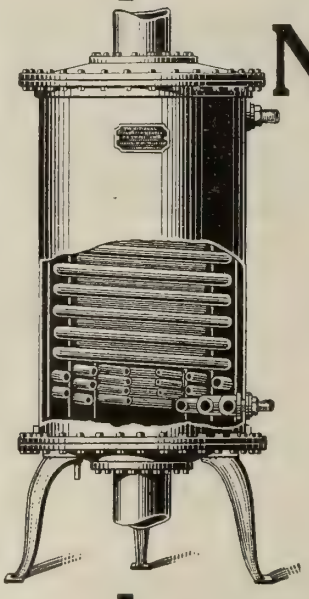
THE STEAM APPLIANCE CO.

MILWAUKEE, WISCONSIN.

CANADA SALES CO., Donalda Bldg., Winnipeg

Pure, Clean, Hot Water

SAVES FUEL MAKES THE BOILERS LAST LONGER



NATIONAL

FEED WATER

HEATERS

Utilize heat in exhaust steam—save fuel.

Coils, not straight tubes —no leaks.

No back Pressure, No Oil.

Send for Catalog No. 1

The National Pipe Bending Co.

91 Lloyd St., New Haven, Conn.

46-16

The advertiser would like to know where you saw his advertisement—tell him.

GRAPHITOL

Pat. and Trade Mark Reg'd.

"Graphitol" is a graphite powder and liquid which, in combination, embody the cement principle applied to the production of a lubricated bearing material of hardness and durability.

No heating is required, and the mixture sets in a reasonable length of time.

Graphitol bearings require less lubricant, as the material is to a high degree self-lubricating, in addition to which it absorbs oil and feeds it evenly over the entire bearing surface without waste.

The heat resisting properties of graphite are well known.

Free illustrated pamphlet will be sent upon request to

British Pacific Supply Company
F. C. Winkler, Manager,
VICTORIA, B. C.
MAKERS OF GRAPHITOL.

Scale Free Boiler Tubes, Boiler Efficiency and Fuel Economy

Are Always the Result of Using

WALKER'S ELECTRIC BOILER COMPOUND

High Grade Oils

Regal Valve Oil
Red Star Cylinder Oil
Monarch Cylinder Oil
Superior Engine Oil
Electric Engine Oil
Vulcan Machine Oil
Heavy Red Machine Oil
Brush Dynamo Oil
Gas Engine Oil and all Engine Supplies

A very small quantity used regularly will keep your boiler tubes **absolutely clean,** and prevent pitting, corrosion, foaming, etc.
The ingredients used in making this compound are harmless to metal; therefore it cannot injure tubes or fittings.
Give it a trial and you will always use it.

The Electric Boiler Compound COMPANY, LIMITED
Guelph, - - Ontario

Schneider & Helmecke, Magdeburg Germany

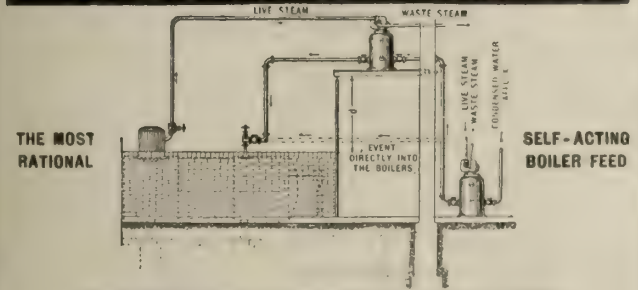
RETURN STEAM TRAP FOR FEEDING BACK HOT

Founded B. in 1878 — ISH — Export

GREAT SAVING IN COALS AND WORKING EXPENSES.
INCREASED BOILER EFFICIENCY.
INCREASED LIFE OF BOILER.
MINIMUM OF BOILER INCRUSTATION.

Special works for Steam Traps

CONDENSED WATER DIRECT TO BOILER, WITHOUT PUMP.



Direct Boiler Feed is also possible with **one** Return Steam Trap according to the situation.

Dominion Sugar Company, Ltd. We received your favour of the 5th inst. and noted its contents. To our great satisfaction we are able to inform you that your **Return Steam Traps,** are working excellently. We have now installed all **four,** which have worked faultlessly right away from the commencement. — **One** double Return Steam Trap suffices for conveying the condensed water from 6 Sperber drying apparatus directly back to the boilers. — *Since the Return Steam Traps were installed the feed pump for the boilers of the splitting-drying department has not been used.* — **The saving in coals is considerable,** since by aid of the Return Steam Traps we can now easily keep up full steam, **whereas previously we had constantly to force the boilers to the utmost.** After the experience gained with your condensed water Return Steam Traps we must admit, that no plant ought to be without the same. **The feed pump has always been a nuisance to us.**
We leave it to your discretion to make whatever use of this you please.
Wallaceburg (Canada), Ont., Novbr. 22 nd, 1909.

The **Morehead Condenser Trap makes its own Vacuum**

and PULLS the accumulated water and air out of your steam lines, insuring rapid circulation. Enables you to cut down your boiler pressure on direct heating systems.

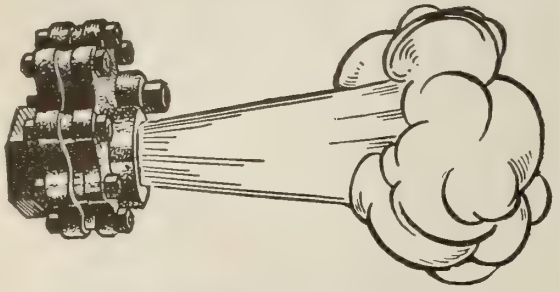
Particularly adapted for use in connection with reduced pressure and Exhaust Steam Heating Systems, Dry Kilns, Dryers, Fan Stacks, Etc.

Write for Particulars and a Trial Trap.

Canadian Morehead Mfg. Co.
WOODSTOCK, ONT.

The advertiser would like to know where you saw his advertisement—tell him.

EVERLASTING
BLOW-OFF VALVES



IT NEVER LEAKS!

WRITE FOR PRICES

200,000 IN USE

Does your Boiler leak, Mr. Engineer?

How often do you blow it?

The "EVERLASTING" is the only perfect blow off valve on the market.

No stuffing box—requires no packing—is self-cleaning, and has a self-grinding seat—nothing to get out of order—What's the answer?

RELIABILITY—SIMPLICITY.

SOLD AND MANUFACTURED UNDER CANADIAN PATENTS BY

Engineering Specialties Company, 1080 King St., West, TORONTO

LIMITED

AGENTS

MONTREAL, QUE.
H. L. Peiler & Co.

ST. JOHN, N.B.
The A. R. Williams Mach. Co.

WINNIPEG, MAN.
The A. R. Williams Mach. Co.

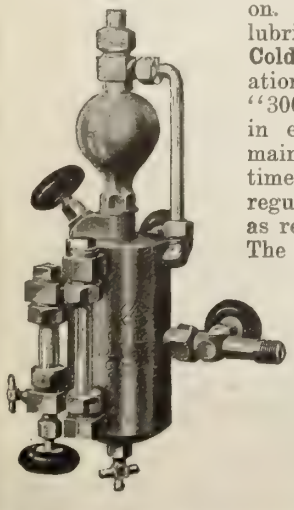
CALGARY, ALTA.
P. D. McLaren Limited

VANCOUVER, B.C.
Taylor-Forbes Company, Limited

New Detroit Grease Lubricator

The new Detroit "300" Grease Lubricator feeds grease, non-fluid oils and similar lubricants evenly, efficiently and economically. It is much the same in construction as the Detroit Improved Standard Lubricator.

The heating chamber is of sufficient size to reduce all the lubricant in the reservoir to a thoroughly liquid condition immediately after steam is turned on. No time is lost waiting for the lubricator to warm up before feeding. **Cold drafts and** temperature variations cannot affect the Detroit "300" in any way. The oil or grease in every part of the lubricator is maintained in a fluid condition at all times, with an even rate of feed, fine regulation and maximum economy as results.



The "300" Grease Lubricator is only one of the new devices introduced by the Detroit Lubricator Company.

Detroit Lubricators have kept pace with every advance in mechanical practice. Whenever a new machine is brought out or a new condition arises, the Detroit Lubricator Company has designed immediately a lubricator for that service—if, indeed, the complete line did not already contain a device that would meet requirements.

Every Detroit Lubricator embodies all the improvements and refinements made possible by long experience in the sale and manufacture of lubricators and by careful study of over 1,250,000 lubricators in use on all kinds of engines all over the world. The Detroit is the world's standard of excellence in lubricating devices.

The big 232-page Detroit catalog tells all about the different kinds of lubricators and other Detroit products—gives complete instructions for installation, care and operation, and contains much valuable information on the general subject of lubrication.

Write for catalog G-58.

CANADIAN DETROIT LUBRICATOR COMPANY, LTD.

WALKERVILLE, ONTARIO

The advertiser would like to know where you saw his advertisement—tell him.

A Profitable Pointer For Power Plant Operators

Why do you suppose that thousands of power plant operators in all parts of the world use Dearborn Treatment to overcome boiler feed water troubles?

It Pays!

Why do you think that we are able to maintain one of the largest and best equipped of modern chemical laboratories, devoted solely to the study and correction of feed water problems?

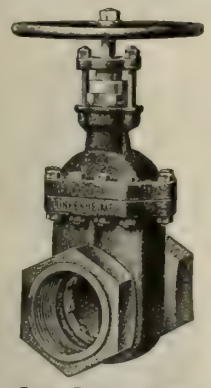
We make Good For Our Clients!

If our service pays other power plant operators, it will pay you. If we have made good for them, we can make good for you.

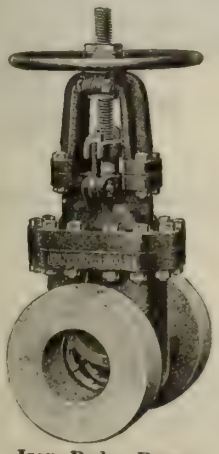
At any rate it's only good business for you to **investigate** any proposition which promises you big economies and big gains in operating efficiency, especially when the promises are backed up with records of results in thousands of cases. Send gallon sample of your boiler feed water, and let us make recommendations for your plant.

DEARBORN CHEMICAL COMPANY

McCormick Building, Chicago



Iron Body, Brass Mounted, Stationary Stem.



Iron Body, Brass Mounted, Rising Stem.

LUNKENHEIMER "VICTOR" GATE VALVES

This line of Gate Valves is the largest and most complete made. It consists of Medium and Extra Heavy **Brass Valves**; Standard, Medium, Heavy and Extra Heavy **Iron Body Brass Mounted Valves**; **"Puddled" Semi-steel and Cast Steel Valves.** All of these patterns are made in two styles—with **Stationary Stem** or with **Outside Screw** and **Yoke**, and in all standard sizes.

The high grade bronze composition used contains a large percentage of copper and tin; the Iron is hard and close-grained, and has a tensile strength of 25,000 pounds per square inch; the "Puddled" Semi-steel, for superheated steam, has a tensile strength of 35,000 pounds, and the Cast Steel, for extreme conditions of strain and superheat, has a tensile strength of nearly 80,000 pounds per square inch.

Lunkenheimer "Victor" Gate Valves are practically indestructible, inasmuch as all parts subjected to wear can easily be renewed, without necessitating their removal from the connecting pipe, and this includes the seats and disc.

The valves are double seated and will therefore take pressure from either side. They are absolutely tight, easily operated, and the stuffing-boxes can be packed under pressure when the valves are wide open.

Specify and insist upon securing genuine **Lunkenheimer make.** Do not accept substitutes—they are never as good as the genuine.

"MOST supply houses sell them—yours CAN—if they DONT or WONT tell US."

Write for Catalogue.

THE LUNKENHEIMER COMPANY

Largest Manufacturers of High-grade Engineering Specialties in the world.

General Offices and Works: CINCINNATI, OHIO, U.S.A.

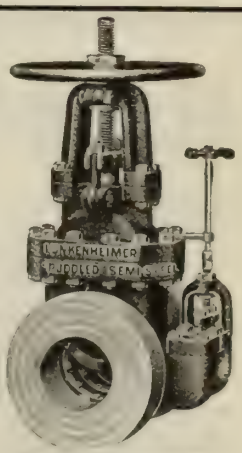
NEW YORK
64-68 Fulton Street

6-43

CHICAGO
186 North Dearborn Street

BOSTON
138 High Street

LONDON, S. E.
35 Great Dover Street



"Puddled" Semi-steel. With By-pass and Rising Stem.

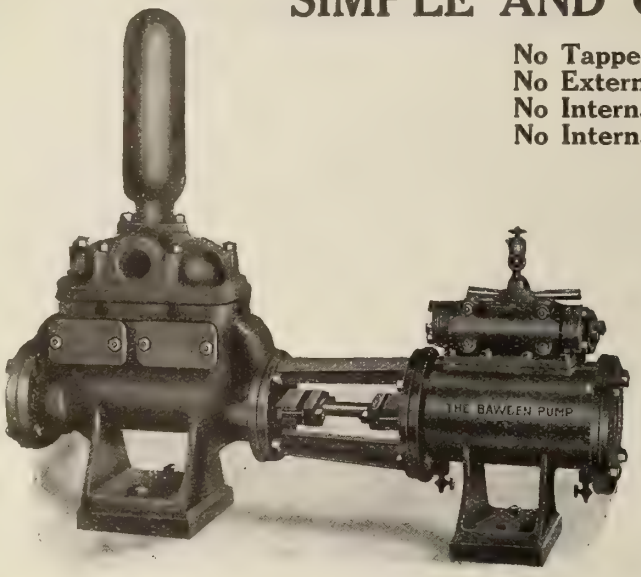
Cast Steel, With By-pass and Rising Stem.

The advertiser would like to know where you saw his advertisement—tell him.

"BAWDEN" STEAM PUMPS

MANUFACTURED UNDER ATTWOOD'S PATENTS

SIMPLE AND COMPOUND, For all Purposes



No Tappets.
No External Valve Gear, Levers or Springs.
No Internal Tubes.
No Internal Stuffing Glands.

"Bawden" Pumps are governed by piston valves which are controlled by the action of live steam only.
—Simplicity throughout.
—Guaranteed to make full stroke under constant or varying loads.
—Valves, latest improved steam balanced type.
—Greatest economy of steam consumption.
The Bawden Pump provides the simplest, most economical and reliable means for feeding high or low pressure boilers.
Flexibility of speed obtained without any mechanical adjustment.
Automatic cushioning of piston and valves ensures greatest safety in any emergency.

THE BAWDEN MACHINE CO., Ltd., Toronto, Can.

Marsh Steam Pump

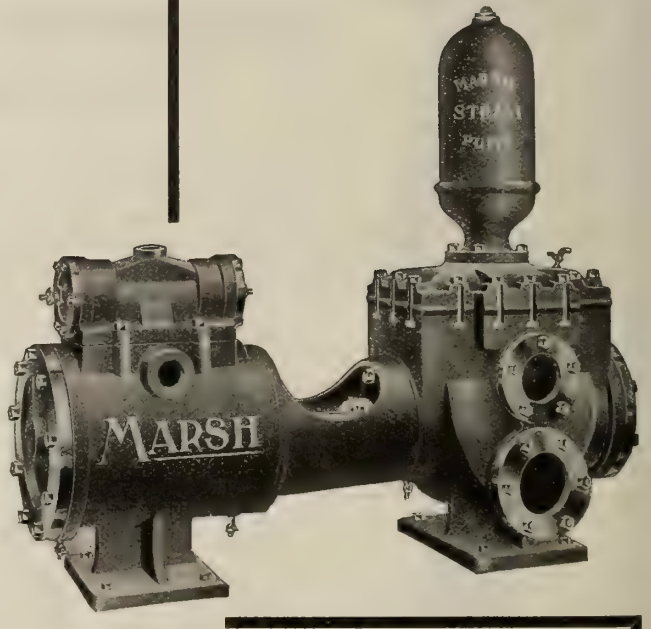
The Pump with the Self-governing Steam Valve

Note the extreme simplicity in construction and the absence of outside valve motion. There is practically nothing to get out of order. Nearly all the wearing parts are made of phosphor bronze instead of common brass, including piston rod, water cylinder lining and valve seats.

The steam valve is self-governing and admits only just enough steam to do the required work. The pump cannot short-stroke, race or pound under the most severe conditions.

115,000 in successful operation.

Ask for Catalog No. 18

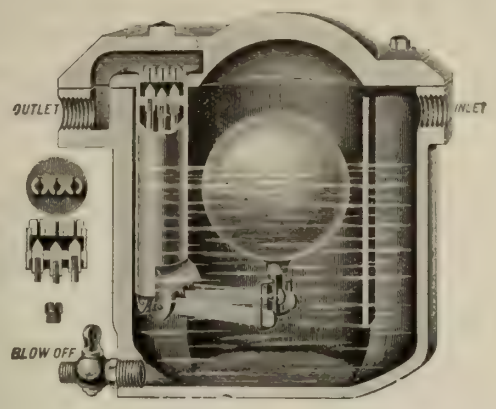


American Steam Pump Company

BATTLE CREEK - - - MICH.

CANADIAN AGENTS

A. R. Williams Machinery Co., Toronto
Williams & Wilson, Montreal
London Engines Supplies Co., London, Ont.
Stuart Machinery Co., Winnipeg
Hallman Machinery Co , Vancouver, B. C.
Mechanics' Supply Co., Quebec, Que.
Gorman, Clancey & Grindley, Limited
Edmonton & Calgary



Wright
"Emergency" High Pressure Continual Flow Steam Trap

THREE VALVES

GREAT CAPACITY

Keeps the steam line automatically and continually drained of accumulating condensation.
Shipped subject to trial and return if results are not satisfactory.
Send for Catalog.

DARLING BROS., Limited
15 Ottawa Street, MONTREAL
TORONTO WINNIPEG ST. JOHN, N.B.

Users Of The
"SIMS" Tubular Feed Water Heater
Find it Invaluable in their Boiler Room

It SAVES Fuel and Boilers

It's the **simplicity of construction, durability** and **extraordinary service-giving qualities** that account for the popularity of the **"Sims" Feed Water Heater.**

It is the result of the embodiment of the highest quality material, scientific methods and the work of experts.

All parts are thoroughly standardized by gauges and templates, and are subject to rigid inspection before leaving works.

We will be pleased to get you in touch with some users, so that you can profit by their experience.

Write for descriptive catalog.

THE SIMS COMPANY, Erie, Pa.

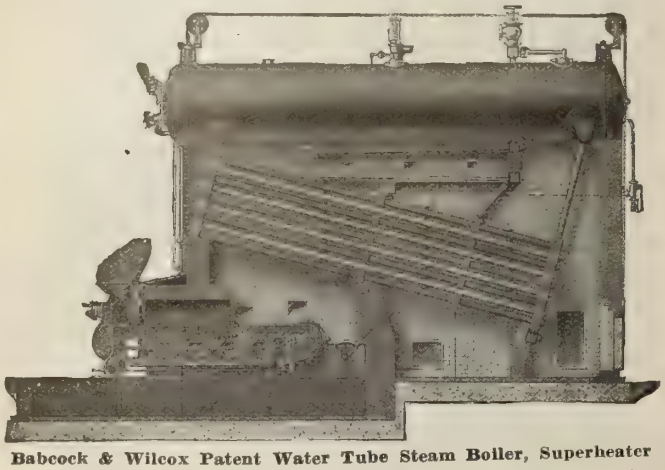
CANADIAN REPRESENTATIVES:
H. L. Peiler & Co., 380 St. James St., Montreal, Que., and 69 Adelaide St. West, Toronto, Ont.

BABCOCK & WILCOX, Limited

"B.&W." PATENT WATER TUBE STEAM BOILERS

With Furnaces for all Classes of Fuel or Waste Gases

HIGHEST ECONOMY, SAFETY, DURABILITY. OVER 10,000,000 H.P. IN USE



Babcock & Wilcox Patent Water Tube Steam Boiler, Superheater and Mechanical Stoker.

ALSO

Steam Superheaters
Mechanical Stokers
Coal-Handling Machinery
Piping, Feed Water Heaters
Water Softeners and Purifiers
and **ELECTRIC CRANES**

Our Book "STEAM" sent on request

HEAD OFFICE FOR CANADA - COLLEGE ST. (ST. HENRY), MONTREAL

TORONTO OFFICE, TRADERS BANK BUILDING

Power Plant Economy Must Begin In The Boiler Room

If the fuel loss is not checked **there**, your engine room results count for little. The little leaks and wastes that get your attention in the engine room are insignificant to the **preventable** waste under your boilers.

The Jones Underfeed Stoker

Is a big paying investment in the small plant. It is a **bigger** paying investment in the bigger plant.

Fuel saving from 10 to 25% interests you. That's what hundreds of Jones Stokers are doing to-day in plants like your own.

Your plant is not an exception. You need a Jones Stoker under every boiler you've got.

We will redesign your furnace, put in a **Jones Stoker** and **show** you. Write us!

How It Operates

Coal is placed in the hopper and automatically pushed into the green fuel bed under the fire, where it is subjected to a coking effect until it in its turn is forced to the top. Each charge of fuel causes a backward and upward movement that keeps the top of the fire, which is nearest the boiler, constantly agitated without opening fire doors. Air for combustion is admitted between the green fuel and the fire bed. The steam pressure itself automatically controls the fuel and air supply, proportioning them to each other and to varying loads in just the correct amount to obtain the most complete combustion possible from any grade of bituminous coal. As grates form no part of the Jones System, loss of fuel through grate bars is impossible. As combustion is commercially complete and air supply is correct, economy results and incidentally the smoke nuisance is effectively eliminated.

Jones Underfeed Stoker Co., Limited

National Trust Building :: TORONTO

The advertiser would like to know where you saw his advertisement—tell him.

THE POWER HOUSE BUYERS' DIRECTORY

To our Readers:—Use this directory when seeking to buy power equipment or supplies. You will often get information that will save you money.

To our Advertisers:—Send in your name for insertion under the heading of the lines you make or sell.

To Non-Advertisers:—A nominal rate of $1 per line a year is charged non-advertisers.

Air Brakes.
Canada Fdry. Co., Ltd., Toronto.
Can. Westinghouse Co., Hamilton.

Air Compressors and Receivers.
W. H. Allen Son & Co. Bedford, Eng.
American Steam Pump Co., Battle Creek, Mich.
Canadian Boving Co., Toronto.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Canada Fdry. Co., Ltd., Toronto.
Can. Westinghouse Co., Hamilton.
Escher, Wyss & Co., Toronto.
Fraser & Chalmers, Ltd., Montreal.
Laurie & Lamb, Montreal.
Smart-Turner Machine Co., Ltd., Hamilton.

Air Vents, Automatic.
Canadian Steam Boiler Equipment Co., Toronto.

Ammeters.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Can. Gen. Elec. Co., Ltd., Toronto.
Can. Westinghouse Co., Hamilton.

Ammonia Fittings.
Canadian Fairbanks-Morse Co., Ltd., Montreal.

Arches, Combustion Chamber.
Canadian Fairbanks-Morse Co., Ltd., Montreal.

Asbestos Specialties.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.
Garlock Packing Co., Hamilton, Ont.

Automatic Electric Machinery.
Chicago Pump Co., Chicago.

Automatic Ice Recording Doors and Chutes.
Jones Cold Store Door Co., Hagerstown, Md.

Autogenous Welding.
Franco-Canadian Welding Co., Toronto.

Babbitt and Anti-friction Metal.
Canada Metal Co., Toronto.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Dominion Metal Co., Sherbrooke, Que.
General Supply Co. of Can., Ottawa.
Hoyt Metal Co., Toronto.
Magnolia Metal Co., New York, N.Y.
Railway Equipment Co., Toronto.

Belt Dressing.
British Pac. Sup. Co., Victoria, B.C.
Cling Surface Co., Buffalo.
Jos. Dixon Crucible Co., Jersey City.
General Supply Co. of Can., Ottawa.
C. C. Snowdon, Calgary.
Stephenson Mfg. Co., Albany, N.Y.

Belt Tighteners.
Manitoba Bridge & Iron Works, Ltd., Winnipeg.
Waterous Engine Wks. Co., Brantford

Belts, Picking.
C. O. Bartlett & Snow Co., Montreal

Belting, Camel Hair.
F. Reddaway & Co., Montreal.

Belting, Stitched Cotton Duck.
F. H. Andrews & Son, Quebec.
Dominion Belting Co., Hamilton, Ont

Belting, Leather.
F. H. Andrews & Son, Quebec.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Dunlop Tire & Rubber Goods Co., Toronto.
Garlock Packing Co., Hamilton, Ont.
General Supply Co. of Can., Ottawa.
Main Belting Co., of Canada, Montreal.
Manitoba Bridge & Iron Works, Ltd., Winnipeg.
D. K. McLaren, Ltd., Montreal.
Sadler & Haworth, Montreal.

Belting, Rubber.
F. H. Andrews & Son, Quebec.
Dunlop Tire & Rubber Goods Co., Toronto.
General Supply Co. of Can., Ottawa.
Jeffrey Manufacturing Co., Columbus.
Quaker City Rub. Co., Philadelphia.

Belting, Scandinavia.
Federal Engineering Co., Toronto.

Bending, Pipe.
National Pipe Bending Co., New Haven, Conn.

Bins, Coal, Coke and Ore.
Jeffrey Manufacturing Co., Columbus.

Blowers.
W. H. Allen Son & Co. Bedford, Eng.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Escher, Wyss & Co., Toronto.
Fraser & Chalmers, Ltd. Montreal.
General Supply Co. of Can., Ottawa.
Hare Eng. Co., Toronto.

Boiler Compounds.
Can. Oil Companies, Ltd., Toronto.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.
W. W. Carruthers, Winnipeg, Man.
Dearborn Chemical Co., Chicago.
Dominion Specialties, Ltd., Toronto.
Electric Boiler Compound Co., Guelph, Ont.
Geo. W. Lord Co., Philadelphia, Pa.
McColl Bros. & Co., Winnipeg.
C. C. Snowdon, Calgary.

Boiler Compound Feeders
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Hare Eng. Co., Toronto.
Lunkenheimer Co., Cincinnati, O.
Morehead Mfg. Co., Detroit, Mich.

Boiler Feed Pumps.
W. H. Allen Son & Co. Bedford, Eng.
American Steam Pump Co., Battle Creek, Mich.
Bawdon Machine Co., Toronto.
Canadian Boving Co., Toronto.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Canada Fdry. Co., Ltd., Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
Deming Co., Salem, O.
Fraser & Chalmers, Ltd., Montreal.
General Supply Co. of Can., Ottawa.
Hare Eng. Co., Toronto.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart-Turner Machine Co., Ltd., Hamilton.

Boiler Feed Regulators.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
General Supply Co. of Can., Ottawa.
Hare Eng. Co., Toronto.
H. L. Peiler & Co., Montreal.

Boiler Mountings.
Babcock & Wilcox, Montreal.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Darling Bros., Montreal.
Lunkenheimer Co., Cincinnati, O.
H. L. Peiler & Co., Montreal.

Boiler Tube Cleaners.
Garlock Packing Co., Hamilton, Ont.
Liberty Mfg. Co., Pittsburg.
H. L. Peiler & Co., Montreal.
Vulcan Tube Cleaning Systems, Ltd., Montreal.

Boilers, Horizontal, Tubular and Watertube.
Babcock & Wilcox, Montreal.
Goldie & McCulloch Co., Galt.
Canada Fdry. Co., Ltd., Toronto.
Canadian Boving Co., Toronto.
Engineering Works of Canada, Ltd., Montreal.
Fraser & Chalmers, Ltd., Montreal.
General Supply Co. of Can., Ottawa.
Jenckes Machine Co., Sherbrooke, Que
Jones Underfeed Stoker Co., Toronto.
E. Leonard & Sons, London, Ont.
John McDougall Caledonian Iron Wks, Montreal.
Ogilvy Eng. Co., Montreal.
Polson Iron Works, Toronto.
International Engineering Works, Ltd., Amherst, N. S.
Railway Equipment Co., Toronto.
Waterous Engine Wks. Co., Brantford

Boilers, Marine, Locomotive and Vertical.
Babcock & Wilcox, Montreal.
Goldie & McCulloch Co., Galt.
Canada Fdry. Co., Ltd., Toronto.
Fraser & Chalmers, Ltd., Montreal.
Jenckes Machine Co., Sherbrooke, Que
E. Leonard & Sons, London, Ont.
John McDougall Caledonian Iron Wks, Montreal.
Polson Iron Works, Toronto.
International Engineering Works, Ltd., Amherst, N. S.
Waterous Engine Wks. Co., Brantford

Boxes, Junction.
Standard Underground Cable Co., of Canada, Ltd., Hamilton, Ont.

Brick Machinery.
C. O. Bartlett & Snow Co., Montreal

Buckets.
Manitoba Bridge & Iron Works, Ltd., Winnipeg.

Cable Hangers and Supports.
Standard Underground Cable Co., of Canada, Ltd., Hamilton, Ont.

Cables, Aerial and Underground.
Eugene F. Phillips Electrical Works, Ltd., Montreal.
Standard Underground Cable Co., of Canada, Ltd., Hamilton, Ont.

Cable, Terminals.
Standard Underground Cable Co., of Canada, Ltd., Hamilton, Ont.

Cans, Oily Waste.
Jas. Morrison Brass Mfg. Co., Toronto.

Carbon Brushes.
Rongier Freres.
Lunkenheimer Co., Cincinnati, O.

Car Movers and Pullers.
Manitoba Bridge & Iron Works, Ltd., Winnipeg.

Cast Iron Fittings.
General Supply Co. of Can., Ottawa.
Lunkenheimer Co., Cincinnati, O.

Castings, Brass and Iron.
Lunkenheimer Co., Cincinnati, O.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
J. C. Wilson & Co., Glenora, Ont.

Cement, Fireproof.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.

Cement Machinery.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
C. O. Bartlett & Snow Co., Montreal

Chemicals.
Dearborn Chemical Co., Chicago.
C. C. Snowdon, Calgary.

Circuit-Breakers.
Engineering Works of Canada, Ltd., Montreal.
Can. Gen. Elec. Co., Ltd., Toronto.
Can. Westinghouse Co., Hamilton.

Clutches.
C. O. Bartlett & Snow Co., Montreal
Elmira Machinery and Transmission Co., Elmira.
General Supply Co. of Can., Ottawa.
Manitoba Bridge & Iron Works, Ltd., Winnipeg.
Waterous Engine Wks. Co., Brantford

Coal and Ash Conveyors.
Babcock & Wilcox, Montreal.
Ed. Bennis & Co., Ltd.
Hare Eng. Co., Toronto.
Jeffrey Mfg. Co., Columbus, O.
H. L. Peiler & Co., Montreal.
Geo. H. Tod, Toronto.

Coal Handling Machinery.
C. O. Bartlett & Snow Co., Montreal
Ed. Bemis & Co., Ltd.
Hare Eng. Co., Toronto.
Geo. H. Tod, Toronto.
Jeffrey Manufacturing Co., Columbus.

Cold Storage Architects.
E. J. Greenstreet, Toronto.

Cold Storage Insulation.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.

Condensers.
W. H. Allen Son & Co. Bedford, Eng.
Alberger Condenser Co., New York.
American Steam Pump Co., Battle Creek, Mich.
Canada Fdry. Co., Ltd., Toronto.
Canadian Boving Co., Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
Fraser & Chalmers, Ltd., Montreal.
Goldie & McCulloch Co., Galt.
John McDougall Caledonian Iron Wks, Montreal.
H. L. Peiler & Co., Montreal.
Hare Eng. Co., Toronto.
Waterous Engine Wks. Co., Brantford

Cold Store Doors and Windows.
Jones Cold Store Door Co., Hagerstown, Md.

Condensation Receiver.
G. M. Davis Regulator Co., Chicago.

Conduits.
E. Leonard & Sons, London, Ont.
Can. H. W. Johns-Manville Co., Toronto.

Consulting Engineers.
Bayfield & Archibald, Vancouver, B.C
Chas. Bishop, M.I.C.S.A., Montreal.
de Gaspe Beaubien, Montreal.
W. N. Dietrich, Montreal.
John T. Farmer, Montreal.
Fetherstonhaugh & Co., Montreal.
Walter J. Francis, Montreal.
Jacobs & Davies, Inc., Montreal.
Pratt & Ross, Toronto.
J. M. Robertson, Montreal.
J. M. Shanly, Montreal.
A. V. Tracy-Gould, Montreal.

Contractors, Structural Steel.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Canada Fdry. Co., Ltd., Toronto.

Conveyor Machinery.
C. O. Bartlett & Snow Co., Montreal
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Engineering Works of Canada, Ltd., Montreal.
Jeffrey Manufacturing Co., Columbus.
Waterous Engine Wks. Co., Brantford

Conveyor Belting.
C. O. Bartlett & Snow Co., Montreal

Cooler Doors.
Jones Cold Store Door Co., Hagerstown, Md.

Cooling Towers.
Alberger Condenser Co., New York.

Copper Rods.
Standard Underground Cable Co., of Canada, Ltd., Hamilton, Ont.

Cork Insulation.
Can. H. W. Johns-Manville Co., Toronto.

Cotton Hose.
Garlock Packing Co., Hamilton, Ont.
Quaker City Rubber Co., Philadelphia.

Couplings.
Canadian Boving Co., Toronto.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Dunlop Tire and Rubber Goods Co., Toronto.
Ellicott Co., A. M., Montreal.
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Jeffrey Manufacturing Co., Columbus.
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Babcock & Wilcox, Montreal.
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Smart-Turner Machine Co., Ltd., Hamilton.

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Lunkenheimer Co., Cincinnati, O.

Crushing Machinery.
C. O. Bartlett & Snow Co., Montreal
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundry Co., Ltd., Toronto.
Fraser & Chalmers, Ltd., Montreal.

Damper Regulators.
Darling Bros., Montreal.
G. M. Davis Regulator Co., Chicago, Ill.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
Jas. Morrison Brass Mfg. Co., Toronto.
H. L. Peiler & Co., Montreal.

Detector Phones.
The Maihak Indicator Agency, Montreal.

Doors, Cold Storage and Freezer.
Jones Cold Store Door Co., Hagerstown, Md.

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S. F. Bowser & Co., Inc., Toronto.

Drying Machinery.
Can. Fairbanks-Morse Co., Montreal.

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W. H. Allen Son & Co. Bedford, Eng.
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Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.

Economizers.
Babcock & Wilcox, Montreal.
Can. Fairbanks-Morse Co., Montreal.

Ejectors.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
Smart-Turner Machine Co., Ltd., Hamilton.

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Canadian General Electric Co., Ltd., Toronto.

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Engineering Works of Canada, Ltd., Montreal.
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Elevating Machinery.
C. O. Bartlett & Snow Co., Montreal
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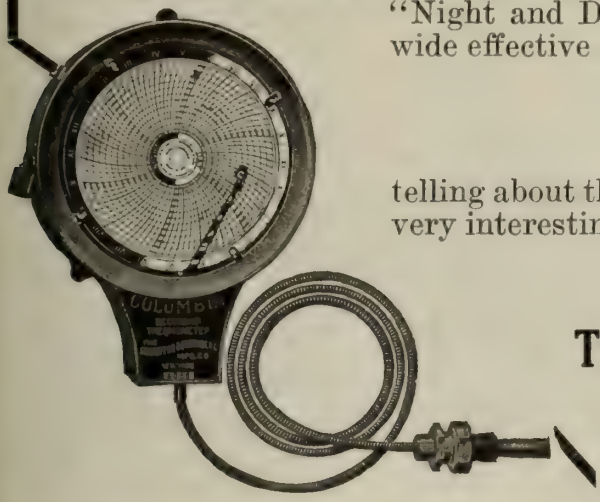

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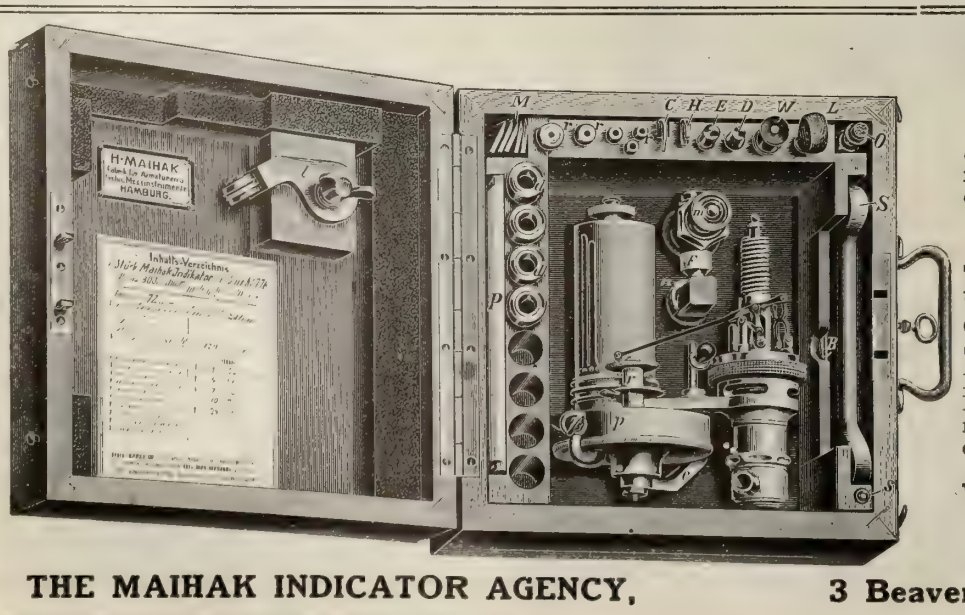

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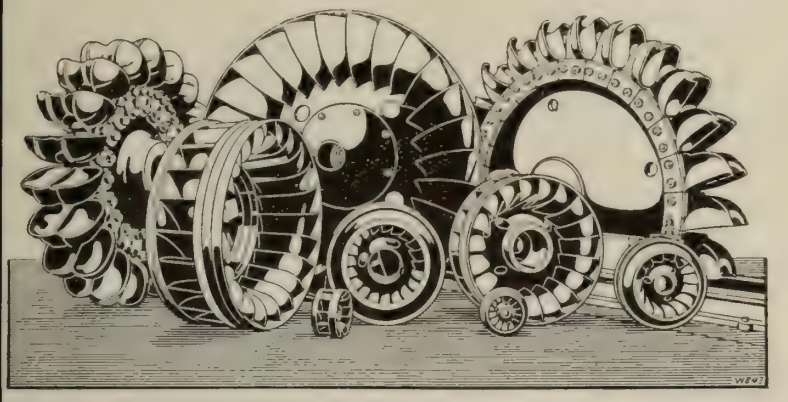


AGENTS:

ONTARIO:

C. J. Printz, 127 Delaware Ave., Toronto.

MAN., SASK., ALTA.

C. L. Trimingham, 45 Canada Life Bldg., Winnipeg, Man.

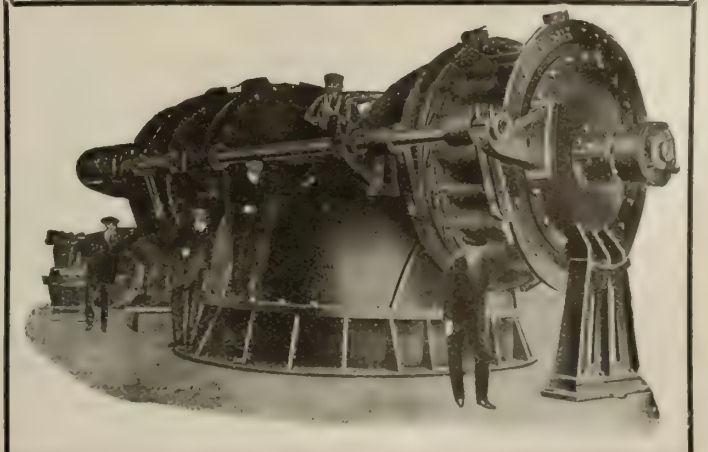
BRITISH COLUMBIA:

Frank Darling & Co., Homer Street, Vancouver, B.C.

WATER TURBINES
—AND—
GOVERNORS

All Sizes

Maximum Efficiency



All Heads

Ideal Control

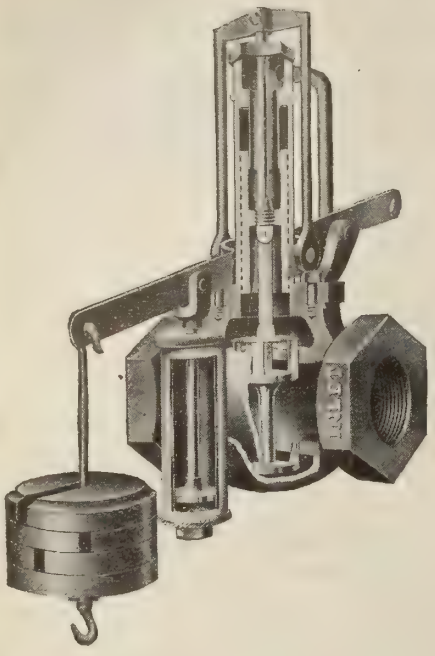
ASK FOR PARTICULARS FROM

THE CANADIAN BOVING CO., LTD.

164 BAY STREET, TORONTO.

Branch Office for British Columbia, 427 Seymour St., Vancouver

The advertiser would like to know where you saw his advertisement—tell him.



There is a Davis Valve Specialty for every problem in the automatic regulation of pressure

You can profit by this man's experience

"We carry 125 pounds pressure on our boilers," wrote an engineer, "and formerly used this pressure throughout our plant.

"I decided, however, that we could operate our pump at a lower pressure and bought a Davis Pressure Reducing Valve to make the reduction automatically.

"We cut the pressure down to 50 pounds and now find that it not only does the work in a satisfactory manner and runs much smoother, but we have the satfaction of knowing that we are saving about 50% in steam consumption by using the lower pressure."

The Davis Pressure Regulator will save steam in every plant where less than boiler pressure can be used effectively. It is fully guaranteed for efficient service and is sold on approval. Let us quote on your requirements.

G. M. Davis Regulator Co.

Established 1875

434 Milwaukee Ave., Chicago

New York—123 Liberty St.
Philadelphia—2528 N. American St.
Boston—70 High Street.
Pittsburgh—First Nat'l Bank Bldg.
St. Louis—735 So. Fourth St.
San Francisco—Rialto Bldg.

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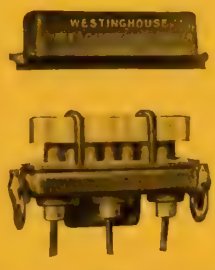
Every contingency of protective service is provided for by the line of

Westinghouse Lightning Arresters

Singly, or in combination, they meet every specific requirement. Conditions, physical and electrical, vary, and must be considered when installing protective apparatus. Our experts with their wide experience will be of material assistance to you in choosing just the type, or combination of types, to meet your particular conditions. . .

Type "G" Arrester, 0 to 2500 Volts, A.C.

These are low-priced arresters for outdoor mounting, and are supplied 2, 3 and 4 pole. A set of non-arcing gaps similar to the C units are used in series with a composition stick resistor which is very rugged, but which can easily and cheaply be replaced when necessary. The resistance limits the flow of power current after a lightning discharge, making the arresters applicable on lines of unlimited capacity.



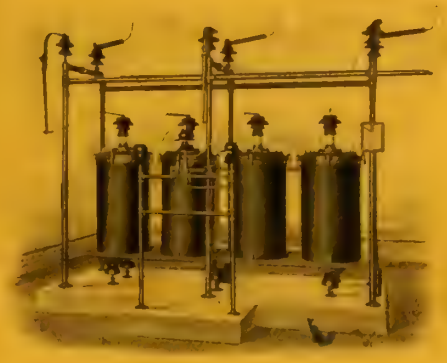
Type "C" Lightning Arrester. 500 to 2500 Volts, A. C.

These arresters consist of a series of gaps between non-arcing metal cylinders. They are the simplest and cheapest to maintain, yet most effective low-priced arresters on the market within their limits of application.

Application may be made at any point on the line when station capacity does not exceed 200 Kw. Where station capacity is greater, these arresters require certain length of line as a limiting resistance between point of mounting and station.

Type "S" Arrester, 1200 to 7000 Volts, A.C.

These arresters will protect circuits the station capacity of which is 2,000 kw. or less. They are small, low equivalent arresters for line use, suitable for single or polyphase circuits with a voltage between the lines not less than 1,200 nor more than 7,000 volts. They are made in two styles: one 3,500 volts, enclosed in an iron case; the other 7,000 volts enclosed in a wooden case, as illustrated. They are also furnished without cases for indoor use.



Type A Electrolytic Arrester

Type A Electrolytic Arrester

2,200 to 165,000 Volts, A.C.

Electrolytic arresters represent the greatest advance ever made in static protective apparatus design. They provide the true unimpeded "safety valve" action in the protection of valuable main, or sub-station apparatus, which has always been lacking in any arrester requiring a limiting resistance in the discharge circuit. Ask for Catalogue Section 445 for explanation of their action.

Westinghouse Type A Electrolytic Arresters gave phenomenally good results during the summer of 1912, when lighting conditions were unusually severe in the West.

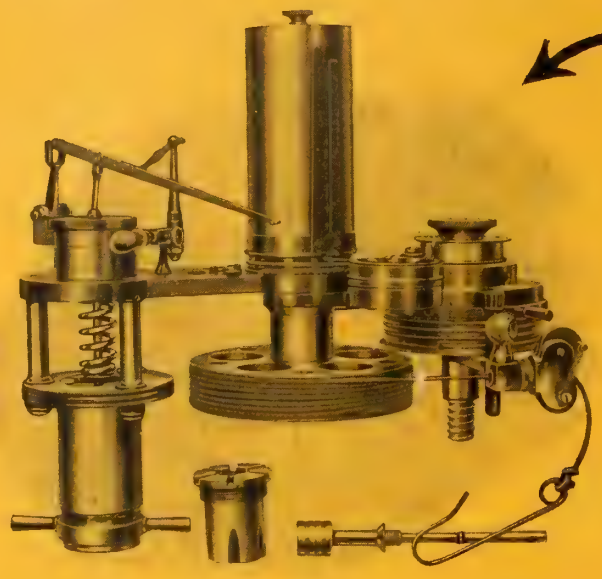
In addition to these Alternating-Current Arresters a full line of Railway Arresters is provided.

Canadian Westinghouse Co., Ltd, Hamilton, Ontario

TORONTO, Traders Bank Bldg. — MONTREAL, 52 Victoria Square — OTTAWA, Ahearn & Soper, Ltd. — HALIFAX, Telephone Bldg. — WINNIPEG, 158 Portage Ave. E.
CALGARY, 311 8th Ave. West — VANCOUVER, Bank of Ottawa Bldg.

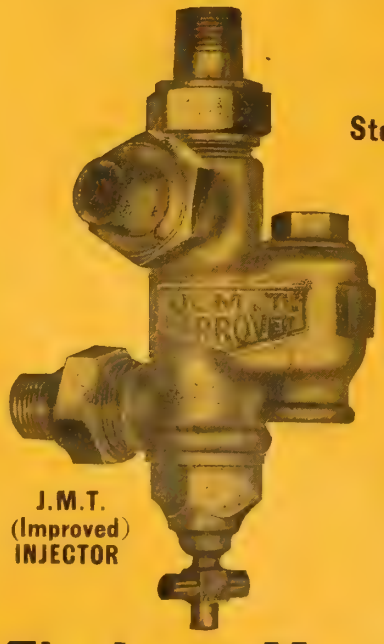
No Modern Operating Engineer Can Afford to be Without

THE TRILL ENGINE INDICATOR



This indicator will show whether or not the valves on the engine are set so as to give the best possible steam economy, and it not infrequently happens that a few minutes work in adjusting these valves will result in reducing the steam consumption of an engine 25 to 50 per cent. for a given load. When it is remembered that in the ordinary industrial plant steam is worth anywhere from 20 to 50 cents per thousand pounds, it is readily seen that the cost of the indicator is insignificant as compared with the saving in money incident to reducing the steam consumption of your engine for a few pounds when figured out for an engine operating 10 to 20 hours a day throughout the entire year.

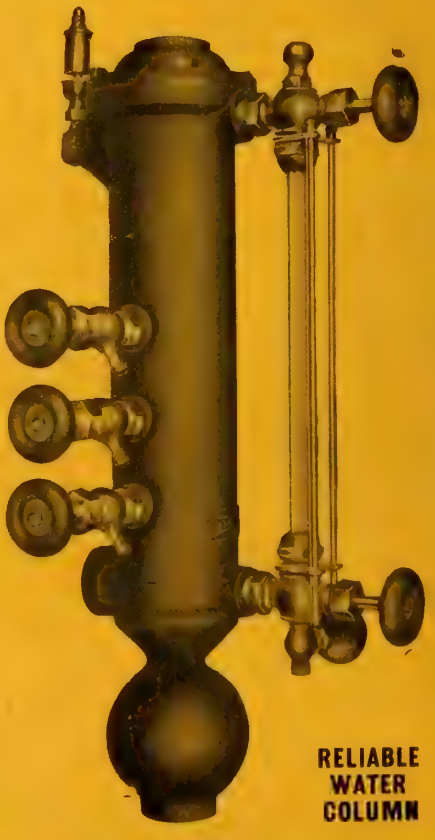
In purchasing a Trill Indicator you take no risk, that is, **we guarantee them absolutely as to accuracy, material and workmanship, and are willing to send one on a 10 days' trial to responsible parties. If it is not as represented it can be returned at our expense.**



J.M.T. (Improved) INJECTOR

Steam

Gauge



RELIABLE WATER COLUMN

We Carry a Full Line of

ENGINEERS' SUPPLIES, BRASS GOODS, PIPE FITTINGS and TOOLS

Write for Descriptive Catalogue.

We guarantee our goods to be of the highest quality, efficient and reliable. When you require anything as mentioned above, ask us for prices and particulars. We'll be glad to give you any information you desire.

The James Morrison Brass Mfg. Co.

LIMITED

93-97 Adelaide St., West **TORONTO**

THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas Electric, Air and Water Power; and to the operation of Refrigerating Machinery.

Published by The MacLean Publishing Co., Limited.

MONTREAL: Eastern Townships Bank Bldg. TORONTO: 143 149 University Ave. LONDON, ENG.: 88 Fleet St. E.C. WINNIPEG: 34 Royal Bank Bldg.

Vol. VI. Publication Office, Toronto—May, 1913 No. 5

TRADE PENBERTHY MARK

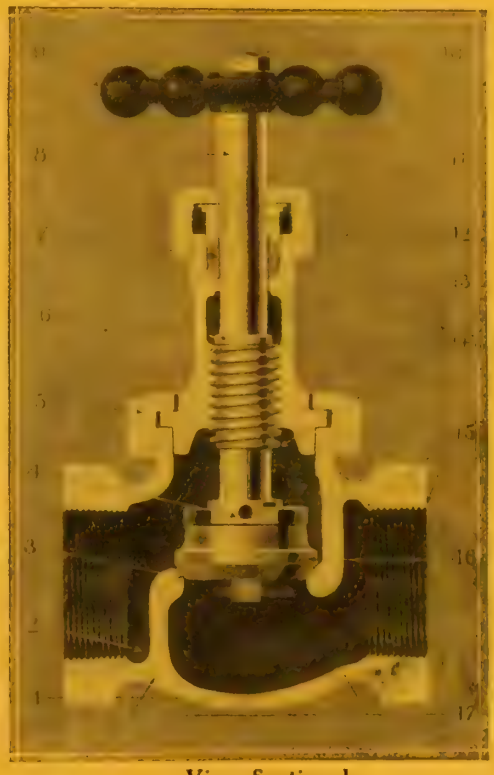
REGRINDING BRASS VALVES

"THE ALL QUALITY LINE"

View Assembled

The Valve YOU Cannot Afford To Do Without

GUARANTEED FOR 200 Lbs. CONTINUOUS PRESSURE



View Sectional

THEY GIVE THE SERVICE

FOR THESE REASONS

SPECIAL QUALITY OF METAL
HEAVY BODY WALL
EXTRA HEAVY HEXAGONS
LIBERAL SEAT THICKNESS
PACKING GLAND FOLLOWER

SPECIAL RING PACKING
BONNET STRONG AND RIGID
THREADED PART OF STEM FULL DEPTH AND TRUE TO STANDARD.

NO DISCS REQUIRED FOR RENEWING. REGRINDING FEATURE ENABLES BOTH THE SEAT OF DISC AND SEAT OF BODY TO BE REGROUND TOGETHER IN ONE OPERATION AT NO EXTRA EXPENSE.

CONVINCE YOURSELVES BY A TRIAL. Send for Booklet "Something Better in Valves." It's free.

Penberthy Injector Co., Limited **Windsor, Ont.**

WE ALWAYS KEEP IN LINE WITH THE IMPROVEMENTS OF THE AGE

FROM THE GENERATION OF STEAM TO THE LAST WORD IN STEAM MAKING APPLIANCES, NOTHING HAS BEEN MADE SO NEAR PERFECTION AS **RAIN-BESTO** PACKINGS FOR PISTONS OF HIGH SPEED ENGINES.

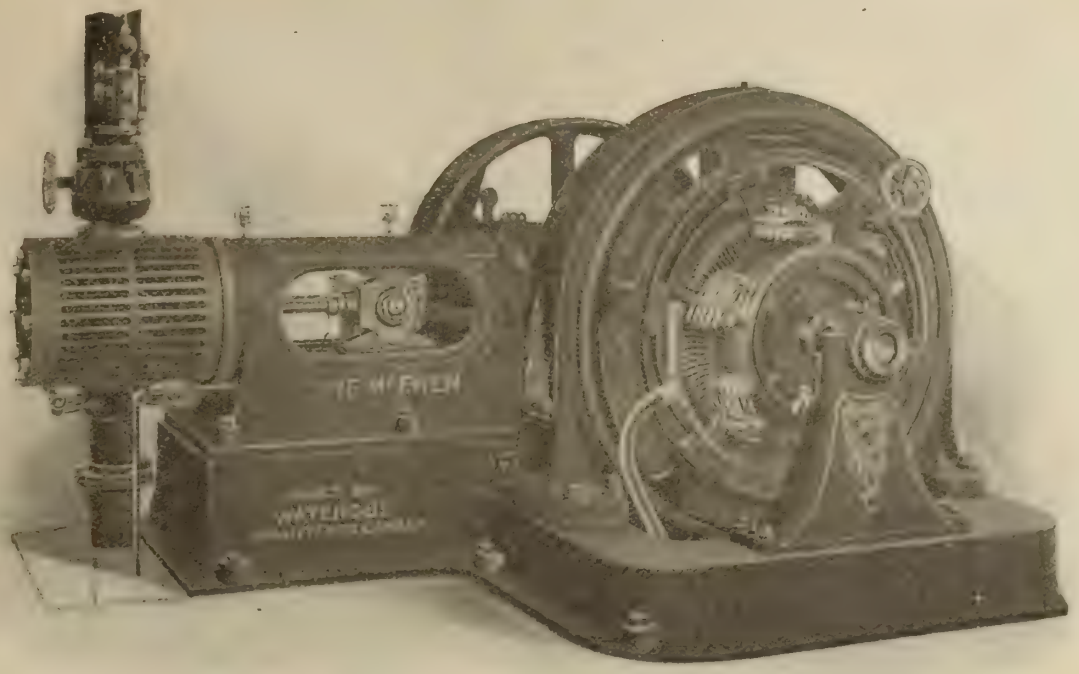
A COMBINATION OF THE BEST LONG FIBROUS ASBESTOS CLOTH MADE AND A CORE OR CUSHION OF THE CELEBRATED **RAINBOW PACKING** COMPOUND IS UNEQUALLED FOR EXTREMELY HIGH PRESSURES.

PEERLESS RUBBER MANUFACTURING CO.

16 WARREN STREET, NEW YORK

FOR SALE EVERYWHERE

The advertiser would like to know where you saw his advertisement—tell him.



Is Your Engine Investment Paying You?

A "low priced" engine is the poorest kind of power investment you can make. Periodic shut-downs and monthly repair bills keep you always from being "paid up in full." Good service makes you forget what you PAID for your engine; constant trouble reminds you what it is COSTING you.

McEWEN ENGINES

Are built with an eye to the future. They are not "low priced," but they have an earning power that makes them "low cost" machines.

Every dollar you put into your McEWEN you get out in economical operation and reliable, satisfactory service.

They are your best insurance against shut-downs and large repair bills. Hundreds of Canadian users will testify to this.

In single and compound units up to 700 H.P.
The "McEwen Booklet" on request.

THE WATEROUS ENGINE WORKS CO., LTD.

BRANTFORD, CANADA

The advertiser would like to know where you saw his advertisement—tell him.

Mr. Power Plant Owner:

Make plans now for renovating that heating system which caused you—No Heat and Freeze Up—troubles last winter. Give this question consideration while the recollection of low shop efficiency and inconvenience from—Little or No Heat—the past winter, is fresh in your mind.

Consider that if you have found it necessary to carry considerable back pressure on your engine to force circulation through your heating system you are doing so at an enormous waste of energy from the coal pile.

A Dunham Vacuum System Will:-

Insure heat in every radiating unit without loss of steam.

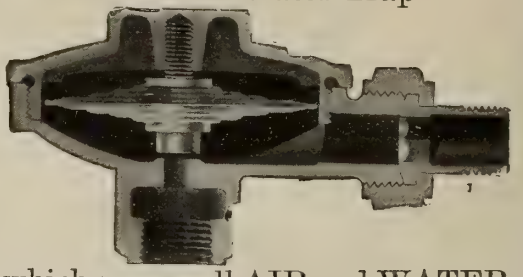
Eliminate all troubles from freeze-ups.

Reduce back pressure on your engine to a minimum (means greater engine economy).

Effects a large saving in your coal bill.

By Use Of

The Dunham Radiator Trap



which passes all AIR and WATER, closes off against STEAM, and proven durable by years of service.

Let us direct you to many satisfied customers who have changed their old unsatisfactory, troublesome system into a Dunham.

Our Engineering Staff is at your disposal

C. A. DUNHAM CO., LTD., Toronto, Can.

Halifax Montreal Vancouver Winnipeg Calgary

Sales Over Five Million Dollars Annually

Four Babbitt Manufacturing Plants

TORONTO LONDON, ENG. NEW YORK ST. LOUIS

Faultless "A" This babbitt is a high grade copper hardened alloy, possessing in a higher degree all the good points of the original Genuine Babbitt, with increased antifriction qualities, having the additional merit of absorbing and holding oil. It is used extensively in France for automobile engines, and in South Africa for mining machinery, and in United States and Canada for marine engines, dynamos and all heavy duty machines. Where heavy service is required this will last longer than any Genuine Babbitt manufactured. For heavy duty, saw mills and engines it is without equal.

Eagle "A" Thousands of tons of this alloy have been placed on the market, giving such perfect results, that it's name and merits are known, we believe, as extensively as any other babbitt manufactured. Its high antifriction and heavy duty qualities make it especially adapted for saw-mills, planing-mills, threshing engines, traction engines, pumps, rolling-mills and general machine shop use.

HOYT METAL COMPANY

TORONTO OFFICE AND MFG. PLANT—EASTERN AVE. AND LEWIS ST.

JENCKES BOILERS

HORIZONTAL TUBULAR
VERTICAL TUBULAR

LOCOMOTIVE TYPES
HEATING BOILERS

Our Boiler department with boilers in various stages of construction.

We manufacture Boilers for low, medium or high pressures, and to pass any inspection.

Our shops, being equipped with the most improved machinery, including hydraulic riveters and flanging presses, we can turn out the highest grade products at reasonable cost.

A reputation for highest quality has only been gained after years of untiring effort, and it is our constant purpose to maintain it.

Write for our Illustrated Catalog and estimates.

The Jenckes Machine Co., Limited

Sherbrooke Montreal St. Catharines Cobalt South Porcupine Nelson Vancouver

Works: SHERBROOKE, QUE. ST. CATHARINES, ONT.

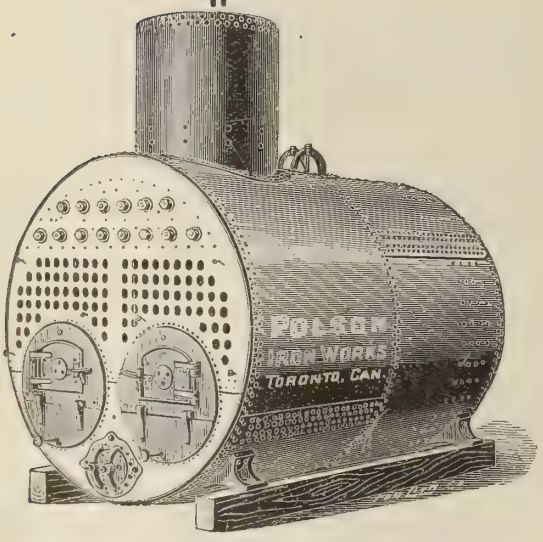
The advertiser would like to know where you saw his advertisement—tell him.

MARINE BOILERS

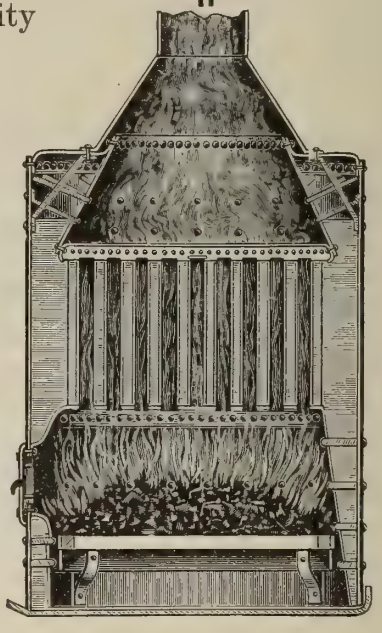
LAND BOILERS

The Utmost in Boiler Efficiency

From start to finish these boilers are under the supervision of experts, and are made by men with long experience. Only the best materials are used, so as to ensure a boiler of unusual durability and safety.



It will pay you to communicate with us and get full particulars. You may need a new boiler soon, and you will want the best.



We build various types:

Scotch, Clyde, Fitzgibbon, Vertical, Mosher.

Horizontal Tubular, Vertical, Locomotive Type, "Heine" Water Tube

GENERAL PLATE WORK

POLSON IRON WORKS, LIMITED

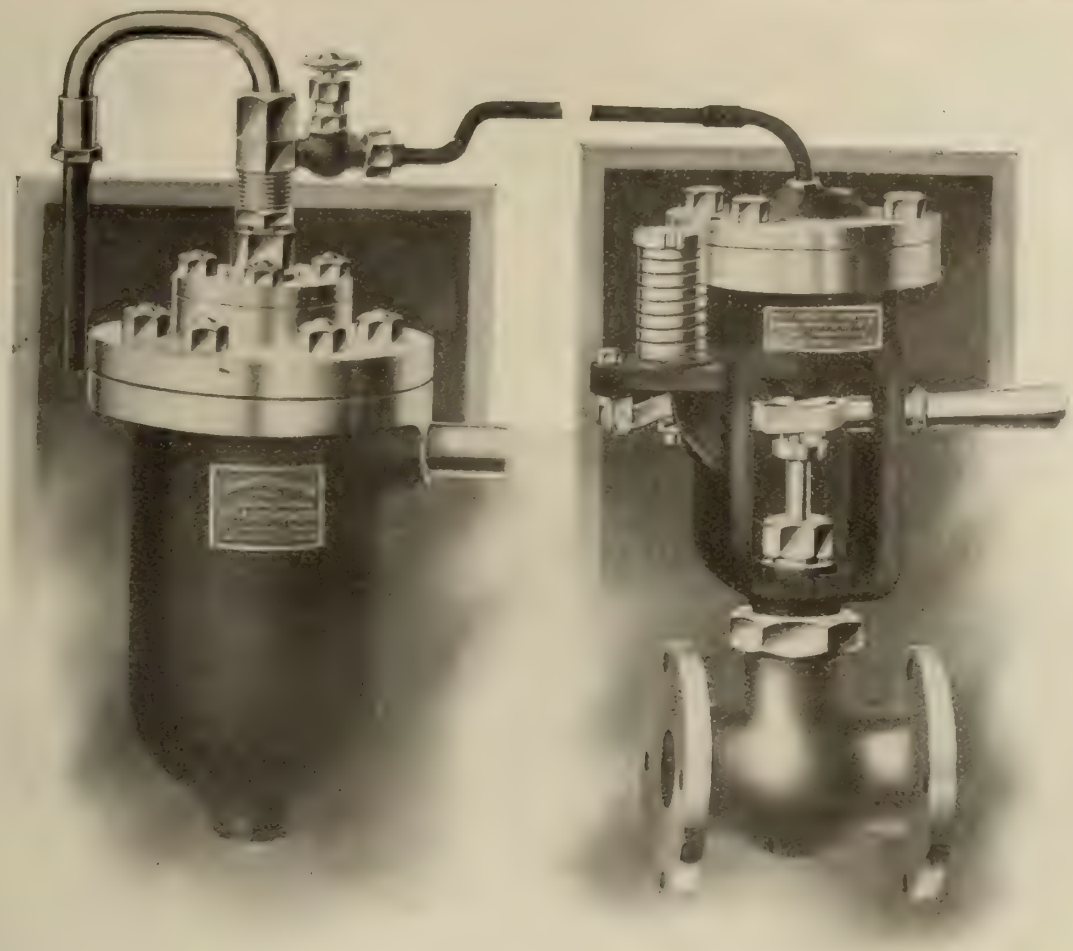
STEEL SHIPBUILDERS, ENGINEERS AND BOILERMAKERS

TORONTO **CANADA**

REPRESENTATIVES IN CANADA FOR

The B. F. Sturtevant Co., Hyde Park, Mass., U.S.A., Fans, Blowers, Heating and Ventilating
The John I. Thornycroft Co., London, England, Marine Motors

The advertiser would like to know where you saw his advertisement—tell him.



IN a Steam Boiler IT IS recognized that the balance of fuel to feed is economical as well as necessary, but the degree or fineness in the adjustment of these two factors is not so generally appreciated, and the reason is specifically interesting; being that no more reliable or accurate means than hand control has ever been successfully devised, so that the problem of fine feed regulation has been left as inopportune, and the losses resulting have been considered as necessary and unavoidable. This is no longer so—the Thermofeed Regulator first makes it necessary to calculate what the losses on the fluctuating levels are, and then prevents those losses entirely.

Send us trial order, giving feed-water temperature, size of feed line, with working pressures—we will do the rest.

We most assuredly can save some of your losses, and the extent to which we can do this will surprise you—it is our special care and study.

RONALD TRIST & Co. Limited

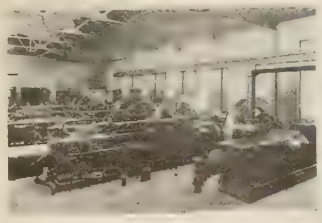
4, Lloyds Ave., LONDON, E.C., England, and 62, Robertson St., GLASGOW, Scotland.

Branches at Manchester, Liverpool, Paris and Vienna.

Telegrams and cablegrams RESVALAR, London, Glasgow and Manchester.

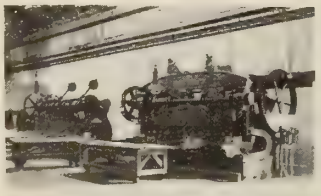
THE FACTORY.

Factory, Toronto, Ont.

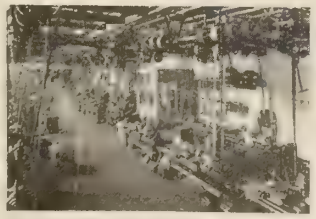


Power Plant.

Heavy Tank Shop.



Light Tank Shop.



One Machine Room.

The Laboratory.

Service for You

It isn't so much the super-excellency of the equipment, its cost or what is its particular function, as it is the service we render you in devising a system that will properly store and accurately distribute the liquids in your own plant, be it large or small.

You know it isn't the intrinsic value of the medicine your doctor gives you which constitutes his service. Nor is it the length of your attorney's plea that enables him to win your case. It is the solving of your individual problem by these two experts through their practical application of the technical knowledge gained by them in years of study and experience.

Now Just What is Bowser Service For You?

It is the work involved in securing your order. A strange statement we admit, but true. How? Just this way.

Suppose you are trying to solve an oil storage and distributing problem. It may be a question involving one department only, or a small plant, or it may be a central oil house for a very large plant. The solution is not found. As an experiment you write Bowser. If the question cannot satisfactorily be

Handled Through Correspondence.

An expert will visit you. He meets every person he can who is interested in solving this problem of yours. He actually works with them to find out through personal contact the actual conditions to be overcome. In many instances he solves your problem on the spot. If not he reports it to us and our expert corps of engineers soon submit a proposal showing what

A Bowser System

will do for you. With this data before you, you can make your own deductions.

By this time you realize that it isn't so much the superior equipment itself that is to be sold you but the solution of your problem by men who have devoted years of their lives solving just such questions for thousands.

Bowser equipment is an investment for the far-seeing man who is looking for big, though sure, returns on his outlay.

Is it any wonder that there are to-day over a

Million Satisfied Users

in every class of business who daily testify by their enthusiastic use of their equipment what Bowser Service has done for them?

Write us for details and remember that no matter how small or large the subject, we are ready to render you SERVICE that will save you labor, time and money.

S. F. BOWSER & CO., Inc.

66-68 Frazer Ave. TORONTO, ONT., CAN.

Made by Canadian Workmen and Sold by Canadian Salesmen.

Sales Offices in all Centers and Representatives Everywhere.

Original patentees and manufacturers of standard, self-measuring, hand and power driven pumps, large and small tanks, gasolene and oil storage and distributing systems, oil filtering and circulating systems, dry cleaner's systems, etc.

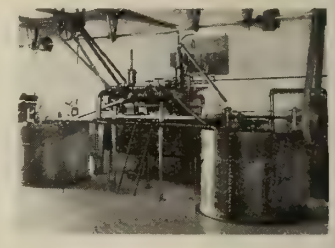
Established 1885.

SOME INSTALLATIONS.

Battery Equipment.
Bates Mfg. Co., Lewiston, Me.

Hand and Power Pumps.
Indiana Steel Co., Gary, Ind.

Filtering.
National Cash Register Co.,
Dayton, Ohio.



Registering Measures.
Dearborn Drug & Chemical Co.,
Chicago, Ill.

Oil Reclaiming System.
Timken Roller Bearing Co.,
Canton, Ohio.

Power Pumps.
C. M. & St. Paul R. R.
Miles City, Mont.

How's Your Packing?

Is it working right up to the limit?
If you are using "*Garlock*" it is.
If not, let us equip you.

You Can Depend on Garlock Packing

WRITE US

REGARDING YOUR PACKING REQUIREMENTS

THE GARLOCK PACKING CO.

HAMILTON, CANADA

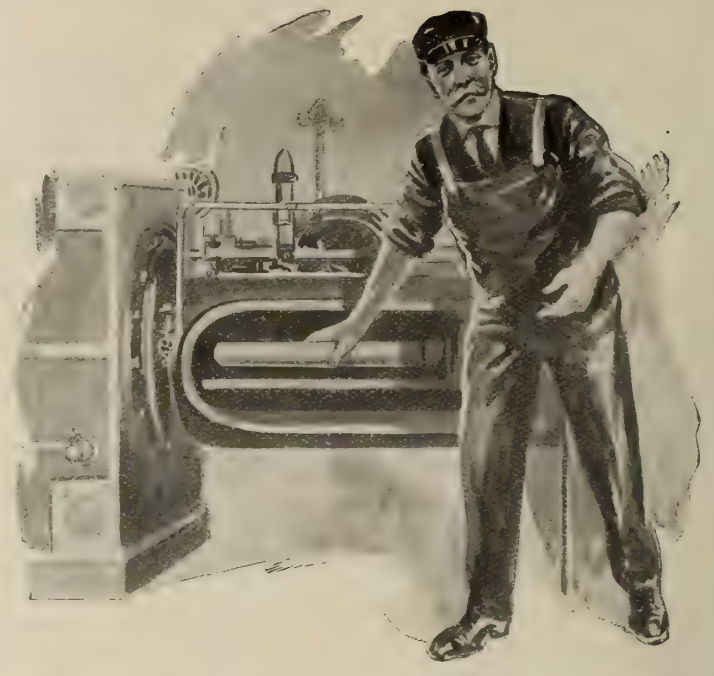
MONTREAL **TORONTO** **WINNIPEG**

BE SURE YOU GET
"*Genuine Garlock*"

The Trade Mark
WILL TELL YOU

"PIONEERS IN THE PACKING BUSINESS."

"This Rod is as Smooth as Glass"



The lubricants used in this packing show the highest friction-reducing efficiency. P. P. P. does make rods "as smooth as glass."

The "sliding wedges" and "compressible cushion" prevent **all** friction during over 75 per cent. of the piston travel, and reduce it to the minimum during the balance of the backward stroke.

DANIEL'S ROD PACKING **P. P. P.** COIL RING SPIRAL

The chief engineer of an Oklahoma electric light company writes: "I like P. P. P. because it saves work, reduces friction to the lowest degree, and saves money for the company."

A California chief engineer writes: "We used ..... packing in our engine without very good success, then tried metallic packing without any success. ..... packing would last about three or four weeks; metallic packing was a failure. P. P. P. lasts for months under very severe conditions."

To Users of P. P. P.

If you are a user of Daniel's P. P. P. Rod Packing, fill out the coupon and mail it to us with the Big Red D—cut from the box lid—and a testimonial letter of your experience with the packing. We will mail you a FREE copy of "The Slide Valve" direct. You will not be required to go to your dealer for the book. Don't forget the letter.

"The Slide Valve" Contains 88 pages; fully illustrated; bound in red. FREE

Fill out coupon, and mail it to us. We will address a book to you, and send it FREE of charge.

Your Name ..... Address.....

Employed by ..... Address.....

Horsepower of Engines .....

Kind of Rod Packing used.....Do you use EBONITE Sheet Packing?.....

Dealer's name ..... Address.....

Buyer's name .....

Series 24E.

The genuine Daniel's P. P. P. Rod Packing (coil form) is put up only in this way. Look for the RED D with a diagonal line across it.

QUAKER CITY RUBBER COMPANY

Manufacturers of Mechanical Rubber Goods

PHILADELPHIA, Pa., U.S.A.

Stop Blow-outs and Leaks in Pipe Lines by Using GOETZE No. 2 ELASTIC GASKETS

If you start right now to renew with No. 2 ELASTIC GASKETS, you can steadily reduce your renewals until you have brought them almost to the vanishing point.

This is not a mere "claim"—it is backed up by a *guarantee*—in fact the strongest guarantee ever made by a gasket manufacturer.

Think what it means to re-gasket a joint so it will *keep tight for years,* instead of days or weeks. Think of the saving resulting in gasket costs, labor and shut-downs.

What No. 2 Elastic Gaskets Will Do

No. 2 ELASTIC GASKETS will make the most troublesome joint you have absolutely tight — and keep it so. They "stay put" and stay tight. Prevent leaks, blow outs and shut-downs. Will practically eliminate renewal expense for gaskets.

No. 2 ELASTIC GASKETS are for high pressure and super-heated steam lines, but owing to their indestructible nature, are equally adapted to *any and every condition* about a factory, mill or refinery.

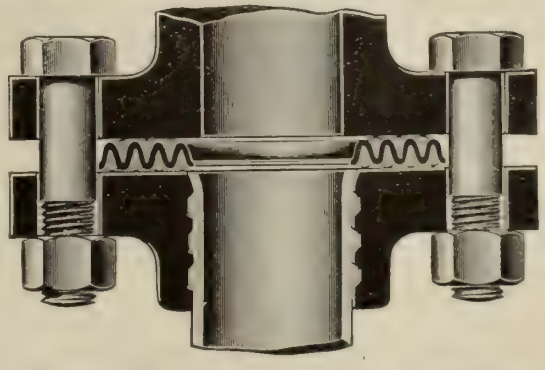
The No. 2 Elastic Guaranteed

Every No 2 Elastic Gasket is Guaranteed for 5 Years Continual Service in the Same Joint

There are no "ifs and ands" about this guarantee. It means just what it says. It applies to every No. 2 GASKET whether bought direct from us or through a dealer.

How No. 2 Elastic Gaskets are Made

These Gaskets are made of corrugated copper with asbestos lining No. 2. The corrugations allow for expansion and contraction of the pipes, while the asbestos, being forced into the



pores of the metals in the flanged surface by the "squeeze" and the constant pressure of the corrugations beneath it, holds securely against the highest pressures.

Goetze Gaskets are carried in stock by

T. McAVITY & SONS, LIMITED

ST. JOHN, N.B.

MONTREAL
112 St. Peter Street

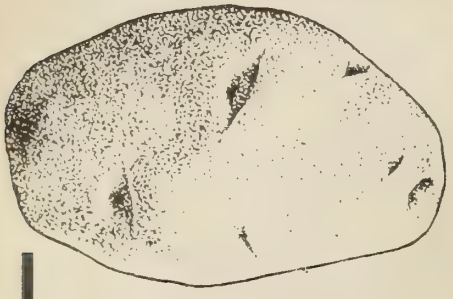
BRANCHES AT
WINNIPEG
C. E. Chown, 147 Bannatyne Street

VANCOUVER
c/o A. O. Campbell, 1069 Hamilton, Street

MANUFACTURED BY

Goetze Gasket & Packing Co., New Brunswick, N.J.

POTATO SCALE



Boiler Cleanser

A Boiler Compound Which Cannot Injure Boiler Tubes or Fittings

We embody no chemicals which are injurious to metal when preparing this boiler cleanser.

A very little used daily in the feed water will not only prevent scale from forming—it will prevent **pitting, corrosion, foaming,** etc., and save you a considerable amount of labor.

Where there is old scale in the tubes **Potato Scale Boiler Cleanser** acts slowly but positively.

Give it a trial, you'll find that it is the most economical way to clean boiler tubes.

Send us a gallon of feed water and **we will mix** a quantity for your approval. If not satisfied **it will not cost you a cent.**

A Combination of High Grade OILS That is Hard to Beat

Numidian Cylinder
Velox Engine
Sliptivity Machine

C. C. SNOWDON

Refiner, Importer and Manufacturer of

Pennsylvania Lubricating and Refined Oils, Gasoline, Potato Scale Powder, Liquid Soap, Disinfectants, Polish, Waste, Oil Tanks, Etc.

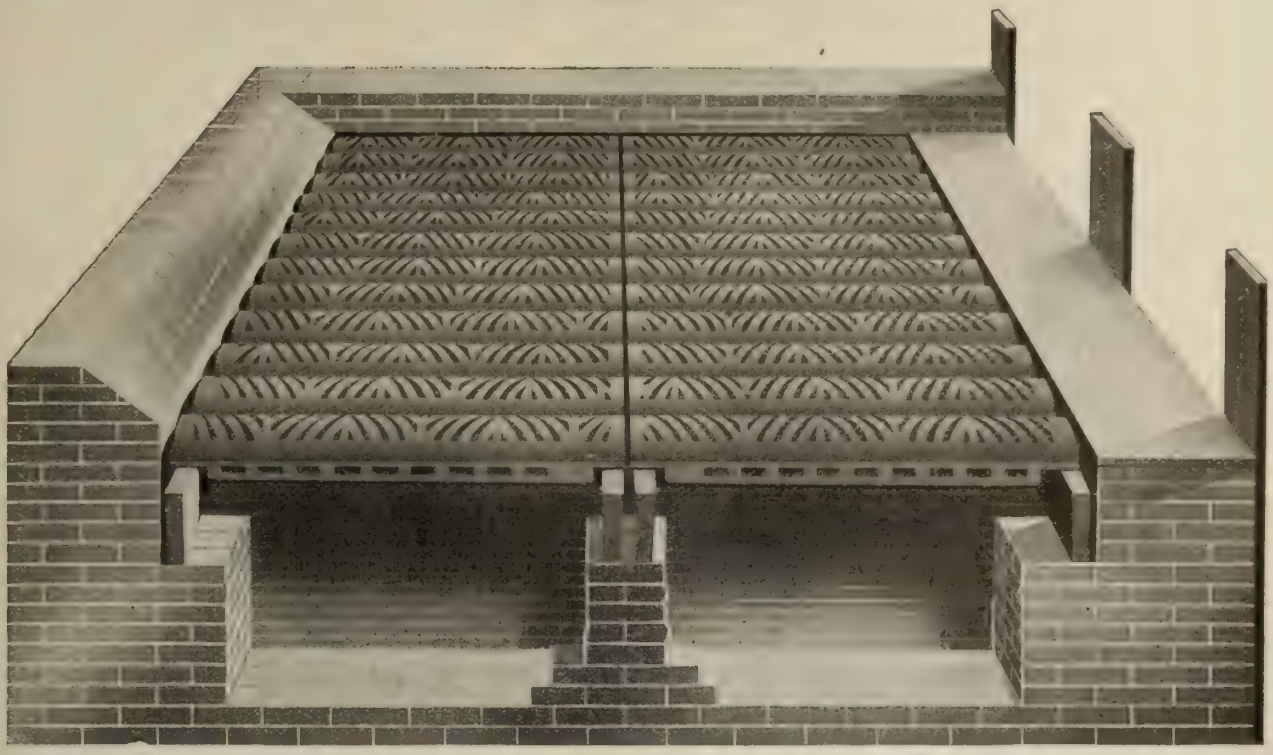
1810-1840 11th STREET EAST, CALGARY, ALBERTA

P. O. Box 1384

THOMAS ELLIPTIC GRATE BARS

SHAKING—CIRCLE—STATIONARY

FOR EVERY FUEL



THOMAS IDEAS

PATENTED

THOMAS ELLIPTIC GRATE BARS	INCREASE STEAM—SAVE FUEL—SAVE LABOR —COST LESS—REDUCE SMOKE.
THOMAS GRATE RESTS	EVERLASTING—PRESERVE GRATE BARS—PROTECT FIRE WALLS.
THOMAS FURNACE SETTING	FIRE WALLS—BRIDGE WALL—FRONT WALL independent of all expanding and contracting irons. SEE THAT AIR SPACE COMPLETELY ENCIRCLING THE GRATE AREA. No dead and burned grate bar ends. No pushed down walls from expansion of grates.

Shipped from Hamilton, Ont. **Let us give you complete information.**

FOR ALL PROBLEMS

Steam—Grate Bar—Furnace—write THOMAS

The General Supply Co. of Canada, Ltd.

OTTAWA TORONTO WINNIPEG

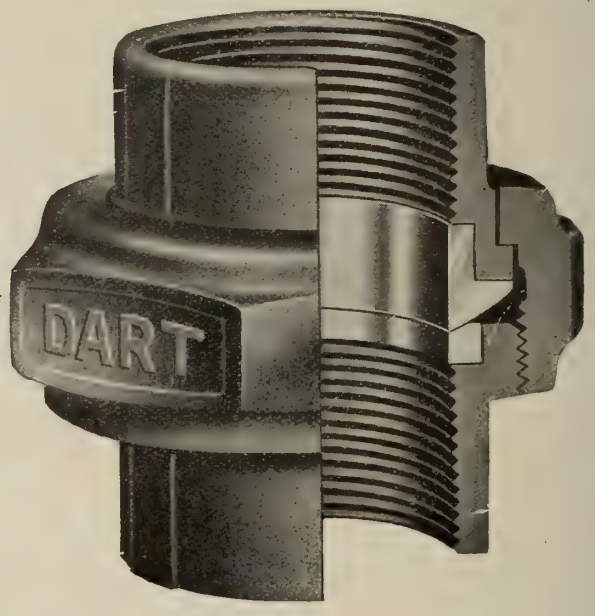
THOMAS GRATE BAR CO., **Birmingham, Ala., U.S.A.**

The "DART"
Union Pipe Coupling

Enables You To Make Perfectly Tight Joints Easily And Quickly

Cannot Rust Or Corrode And Is Not Affected By Vibration, Expansion Or Contraction

Bronze To Bronze At The Joint



THIS TRADE MARK DART

which is cast on every Union which we ship, represents our guarantee that we will replace any Dart Union found defective with TWO new ones.

JOBBERS HAVE DART UNIONS IN ALL CONVENIENT TYPES

Dart Union Co., Limited
TORONTO, CANADA

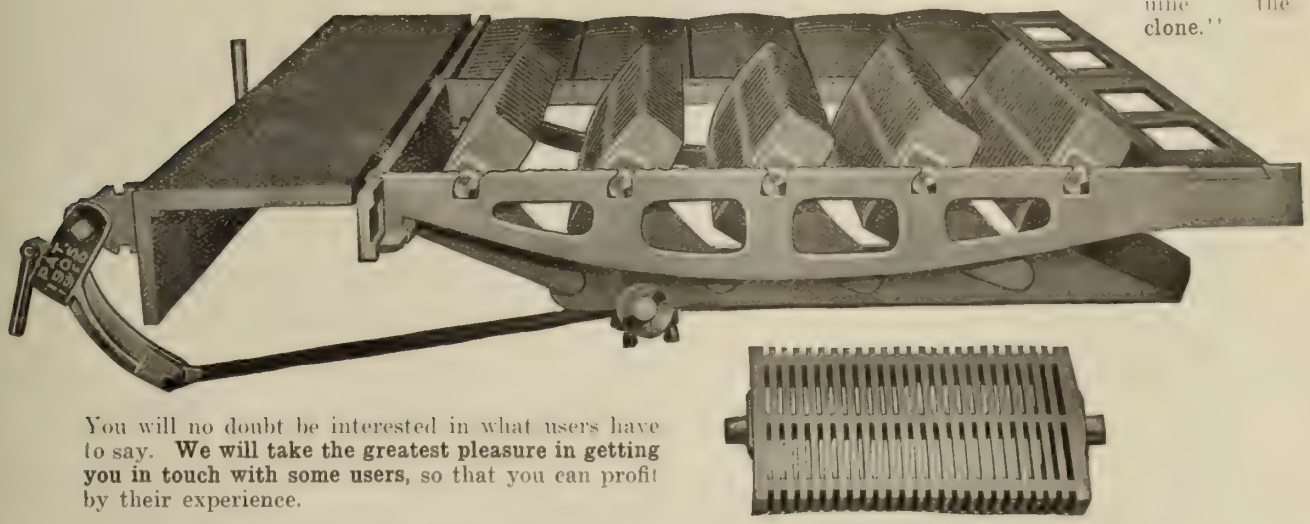
The advertiser would like to know where you saw his advertisement—tell him.

"THE Cyclone"

Shaking and Dumping Grate Bar

Locks level, cannot get out of adjustment or become warped, 63 per cent. air space, 90 per cent. under draught, more vigorous and effective shaking is the result of improved shaking mechanism---no ashes can cling to the centre of the grate, burns the cheapest grades of fuel with results equal to that of the best, generates more steam from less fuel than any other. Built upon the plan to enable the engineer to fire light and keep his fires free from ash.

There are imitations on the market, and it will be to your advantage to make sure you get the genuine the "Cyclone."



You will no doubt be interested in what users have to say. **We will take the greatest pleasure in getting you in touch with some users,** so that you can profit by their experience.

Write for full particulars.

CANADIAN STEAM BOILER EQUIPMENT COMPANY, Ltd.

SOLE MANUFACTURERS FOR CANADA

211 QUEEN STREET EAST :-: :-: :-: TORONTO, CANADA

AGENTS

ST. JOHN, N.B., F. W. Blizard, Canada Permanent Chambers. MONTREAL, H. L. Peiler & Co., 308 St. James Street.
HAMILTON, Robt. Fitzsimmons, 8 Grove Street. CALGARY, Alta., The Western Foundry & Metal Co., Limited.
BERLIN, J. Hainsworth, 14 Foundry Street. WINNIPEG, Vulcan Iron Works.

The advertiser would like to know where you saw his advertisement—tell him.

LUNKENHEIMER SUPERIOR STEAM BOILER VALVES AND FITTINGS

CONFORM WITH CANADIAN BOILER REGULATIONS AND ARE APPROVED FOR USE IN WESTERN CANADIAN PROVINCES, INCLUDING BRITISH COLUMBIA ALBERTA AND SASKATCHEWAN

The line approved includes globe, angle, cross, check, non-return safety boiler stop, gate, blow-off and pop safety valves, water gauges, gauge cocks, etc.

A complete list of official registration numbers covering the above will be sent upon request.

The supremacy of LUNKENHEIMER PRODUCTS is universally acknowledged, and to maintain this reputation, the highest type of skilled labor is employed and only new material of the very best grade is used.

We guarantee our goods to be of the very highest quality, and a LUNKENHEIMER GUARANTEE is a real definite quantity and not an empty use of the meaning of a guarantee.

All correspondence and inquiries receive prompt attention, and immediate shipments are assured, as large stocks are carried.

Our products are carried in stock by most supply houses. Those that do not carry them can get them for you, but if they will not, write us.

WRITE FOR 1913 CATALOGUE.

THE LUNKENHEIMER COMPANY

Largest Manufacturers of High Grade Engineering Specialties in the World

GENERAL OFFICES AND WORKS:
CINCINNATI, OHIO, U. S. A.

NEW YORK, 64-68 Fulton Street.
BOSTON, 138 High Street.
CHICAGO, 186 North Dearborn Street.
LONDON. S.E., 34 Great Dover Street.

32-43

The advertiser would like to know where you saw his advertisement—tell him.

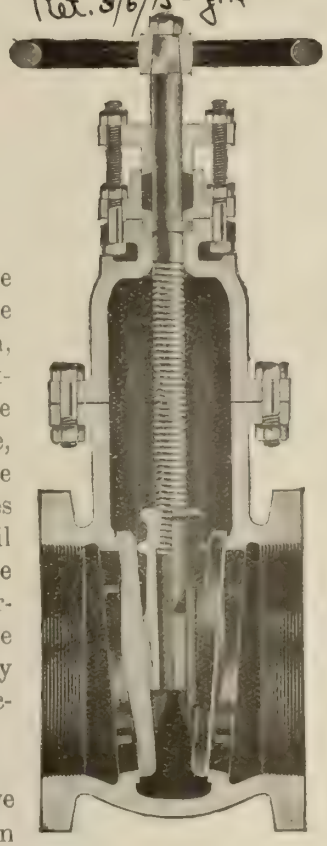
JENKINS BROS.'

IRON BODY GATE TYPE "K"

VALVES

Fig. 401.

TESTED TO 300 LBS. HYDRAULIC PRESSURE



FOR 125 LBS. WORKING STEAM PRESSURE

Fig. 402.

Fig. 403.

Jenkins Bros.' Type "K" Gate Valves are unrivalled in design, material and workmanship. They are neat in appearance, and can safely be used under pressures of Steam, Water, Oil or Air. All parts are renewable and interchangeable, and the discs close positively with Ball-bearing action.

This style of valve can be furnished in "ALL IRON" for use on Cyanide, Gas, etc., if so desired, also with Sliding Stem and Lever.

The following good features are to be found in these valves:

Opening equal to nominal diameter of pipe.

Can be operated in any position.

Double Compensating bronze-faced discs.

Non-possibility of discs jamming.

Bronze seat-rings screwed in and renewable.

Stuffing box can be repacked under pressure, with valve wide open or closed.

Seat-rings and disc faces of special bronze.

TRADE JENKINS MARK

Fig. 404.

Fig. 400.

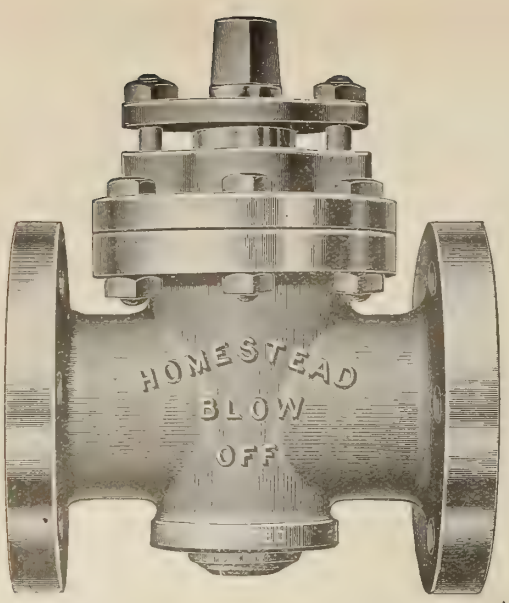
SOLE MANUFACTURERS

JENKINS BROS., Limited

103 St. Remi Street MONTREAL

Write for copy of our New Catalog which describes the entire line of JENKINS BROS.' Valves.

Fig. 406.



Homestead Valves

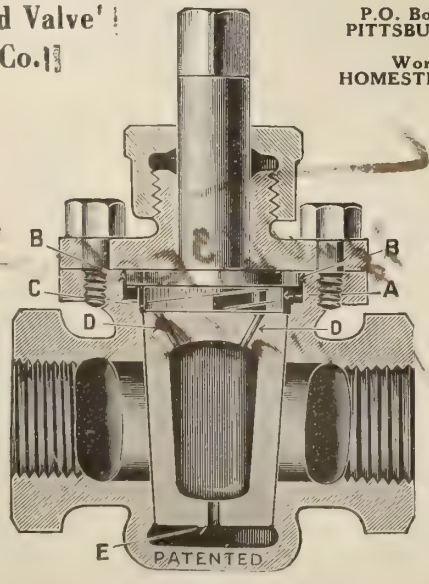
A quarter turn—just a slight twist of the wrist—closes or locks the *Homestead*. A quarter turn back opens it wide. It being free from friction, long life and the maximum of service is assured. This valve cannot jar open—when you lock it, it stays locked. The seats are perfectly protected from wear both when closed and when pressure is passing through them. *Every valve* is hand ground to a perfect fit and tested before shipment. They are absolutely leak-proof under any steam, air or hydraulic pressure. *Homestead Valves* are giving satisfaction throughout the entire world, under the most severe conditions. Just try one if the valves you are now using are weak in some essential point. The many superior points of *Homestead* Straightway, Three-way and Four-way Valves fully described in our catalog. Have a copy?

are Quality Valves

Homestead Valve Mfg. Co.

P.O. Box 1754
PITTSBURG, PA.

Works:
HOMESTEAD, PA.



GRAPHITOL

Pat. and Trade Mark Reg'd.

"Graphitol" is a graphite powder and liquid which, in combination, embody the cement principle applied to the production of a lubricated bearing material of hardness and durability.

No heating is required, and the mixture sets in a reasonable length of time.

Graphitol bearings require less lubricant, as the material is to a high degree self-lubricating, in addition to which it absorbs oil and feeds it evenly over the entire bearing surface without waste.

The heat resisting properties of graphite are well known.

Free illustrated pamphlet will be sent upon request to

British Pacific Supply Company
F. C. Winkler, Manager,
VICTORIA, B. C.
MAKERS OF GRAPHITOL.

SPECIAL WORKS FOR STEAM TRAPS

Established 1878 Exportation

Speciality:

SCREW-VALVE STEAM TRAPS.

RETURN STEAM TRAPS
for Feeding Back Hot Condensed Water direct to Boiler,
— Without Pump. —

EQUILIBRATED FLOAT-VALVES.

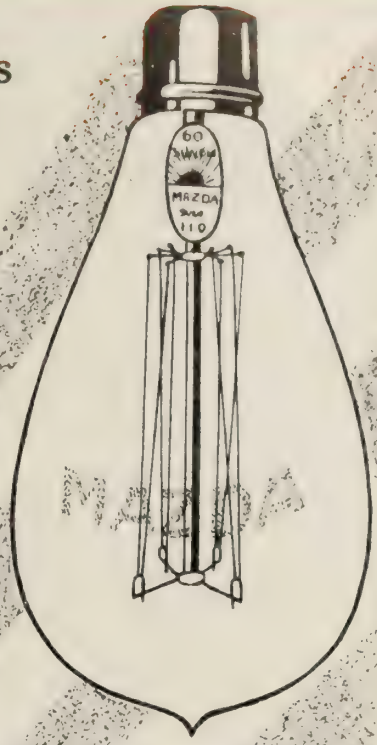
AUTOMATIC WATER ESCAPE VALVE
for Draining the Cylinders of Steam Engines.

GRAPHITE OIL LUBRICATING PRESS
About 70% of Oil saved!

DUPLEX-DRAFT INDICATOR
for Boiler-Furnace.

The advertiser would like to know where you saw his advertisement—tell him.

Why use Carbon Lamps when You can get 3 Times the Light at same Cost by using



SUNBEAM

MAZDA
Drawn Wire
TUNGSTEN LAMPS ?

The quality of these lamps assures a long service.

It will pay you to give them a trial.

The Canadian Sunbeam Lamp Co. LIMITED

Main Office and Factory: TORONTO

Branch Warehouses MONTREAL WINNIPEG CALGARY VANCOUVER

ADMIRAL

C. J. MacCONNELL
(DECEASED)

UNITED STATES NAVY

had charge of the tests of Magnolia Metal at the New York Navy Yard in 1887.

Twelve years after these tests he wrote the letter shown hereon, giving the results of his personal and practical experience with Magnolia on board the war vessels of the United States Navy, of which he was the Fleet Engineer. It will be observed that he had a high regard for Magnolia. The tests referred to are fully set forth in the Annual Report of the Secretary of the Navy for year 1888, covering fourteen pages.

TRADE MARK

± 281 Fairmont Avenue
Brooklyn N. Y. April 3rd 1899

Magnolia Metal Company

My Dear Sirs.

I freely state to you that I have always used the "Magnolia Metal" in preference to any other compound as I was firmly convinced of its superiority after the conclusion of the long experiments made on the New York Navy Yard under my own supervision I went into this trial fairly unbiased, in fact if there was any preference in my mind it favored the Parsons White Metal as I had heard a great deal about it but the Magnolia was quite new to me. The results were a surprise to myself and the reports shows it to be superior in every way.

During the last nine years or more I have served on board the U S S. war vessels "Mohican" "Olympia" and Charleston" in the Pacific the "Lancaster" in South Atlantic the Flag ship "New York" in the North Atlantic Squadron, of which I was the Fleet Engineer. I found the "Magnolia Metal" in the store rooms of these ships and used it in all occasions when a journal needed re-babbiting or filling with an anti-attrition metal: It always worked successfully for me

I used to more largely about the Machinery of the Charleston" and was always able to get my bearings and main journals finer than with ordinary babbit or other metals the engines of this ship on the voyage from Yokohama to San Francisco worked like clocks perfectly smooth and finely adjusted, not a hot bearing I have never had any trouble with the "Magnolia Metal," owing, perhaps to the fact that I obtained the genuine brand and was careful in its use. It should not be too hot in melting and constantly stirred while pouring with a pine stick which keeps the mechanical mixture of plumbago in it thoroughly diffused in the mass For quick moving engines such as dynamos and Electric Motors or Torpedo Boat engines I consider it invaluable

Very Truly Yours
C J MacConnell
Chief Engineer U.S.N.
Retired.

REDUCED FAC-SIMILE

SOLD BY LEADING DEALERS EVERYWHERE OR BY

MAGNOLIA METAL CO.

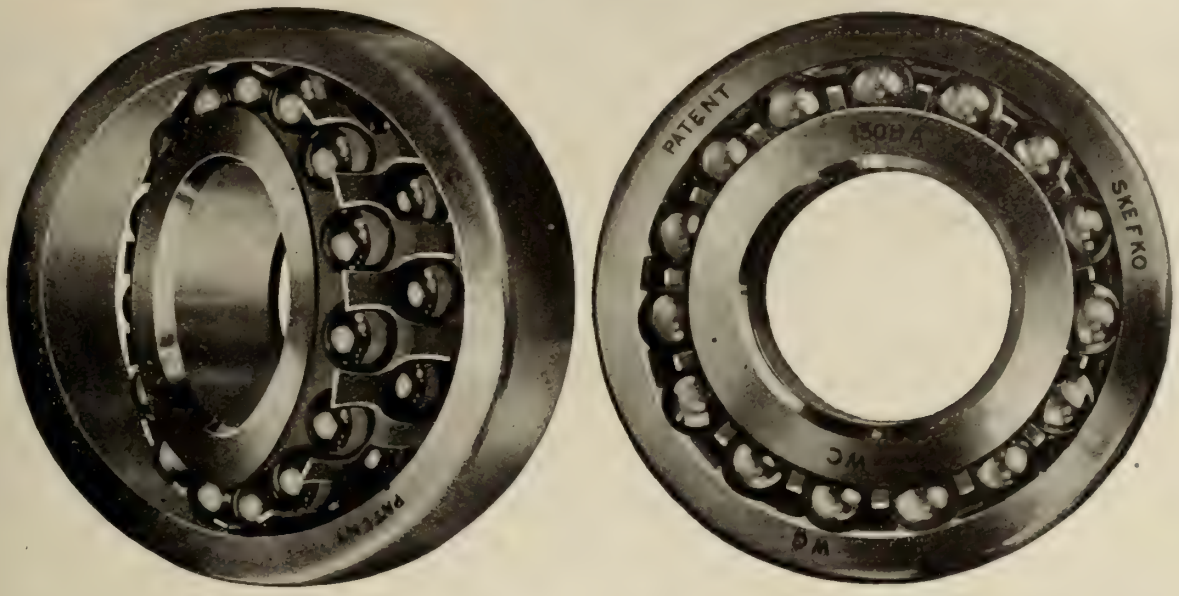
Office and Factory: 225 St. Ambroise St., Montreal

SPECIAL OFFER

PRACTICAL ENGINEER POCKET BOOK—700 pages ; over 2000 subjects. Price 40c post paid. We import these books in large numbers from England, as an advertising medium, and give Engineers benefit of low price. They are highly spoken of. Address Montreal Office.

The advertiser would like to know where you saw his advertisement—tell him.

No User of Ball Bearings Can Afford to Neglect these Points



1. **Double Row of Balls**—virtually two bearings in one, a splendid feature under any load condition.
2. **Pressed Retainer in One Piece**—made from Swedish Lancashire Iron. No rivets, wires or screws to work loose, jam balls, disarrange spacing or make noise.
3. **Outer Race Spherical**—providing for a frictionless self-alignment that absolutely and automatically compensates for shaft spring.
4. **Best Swedish Crucible Steel**—Carefully heat-treated and uniform in hardness throughout. Unequalled for toughness, carrying capacity, accuracy and durability.

SKEFKO

is the only truly self-aligning bearing. This feature alone is worth most careful consideration.

¶ SKEFKO Self-Aligning Double Row, Double-Capacity, Double-Life Ball Bearings cost no more and are made in international standard sizes. Their use is practical under any speed and load condition and the lubrication and protective housing can be made to conform to any service requirements.

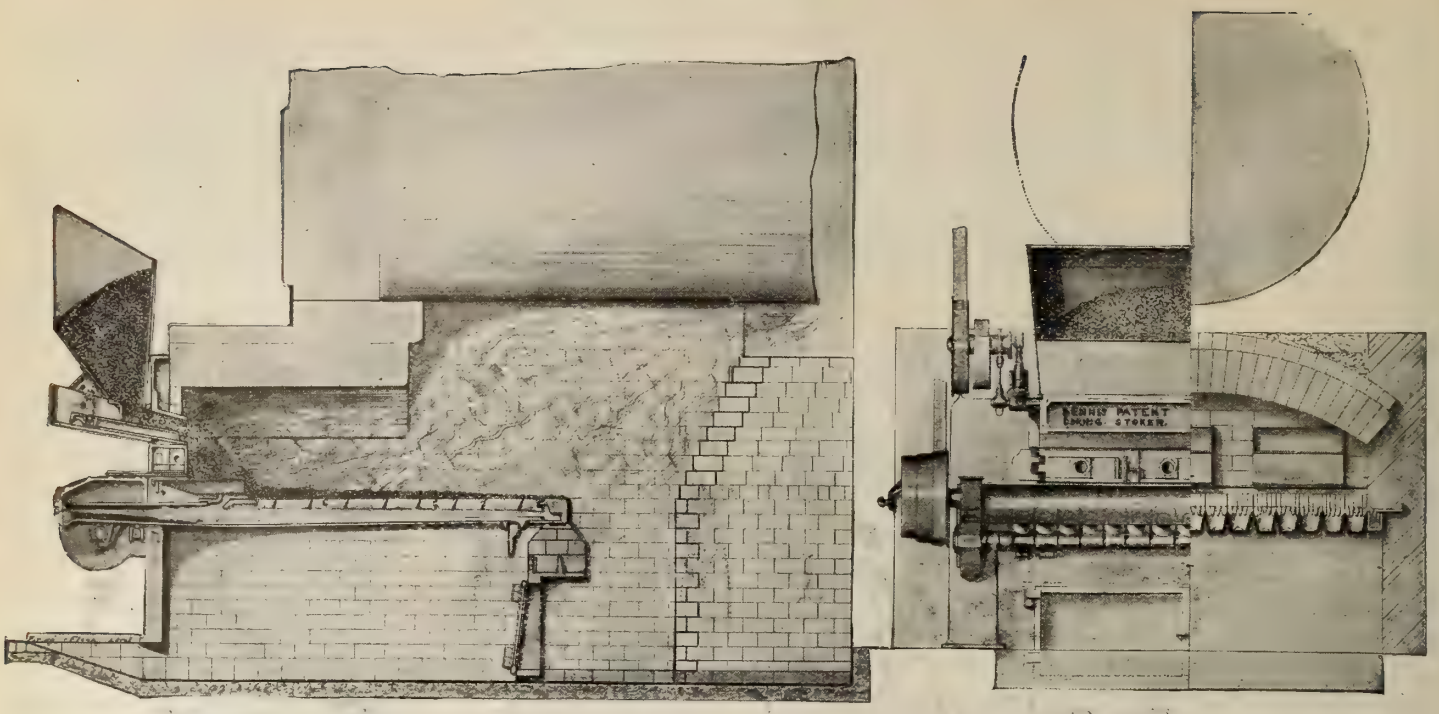
¶ SKEFKO Bearings are the recognized standard and are replacing other constructions in many types of machinery.

¶ Our literature explains these matters in detail. Your best interests demand that you investigate. Tell us your bearing troubles and ask for our bulletins.

SALES AGENTS

The Canadian Fairbanks-Morse Co.
Limited

ST. JOHN QUEBEC MONTREAL OTTAWA TORONTO
WINNIPEG SASKATOON CALGARY VANCOUVER



LONGITUDINAL SECTION FRONT VIEW

ARRANGEMENT OF BENNIS COKING STOKER APPLIED TO HORIZONTAL RETURN TUBE BOILER

MILLIONS OF DOLLARS are SAVED YEARLY by the USE of BENNIS MACHINE STOKERS

WRITE FOR A FULL SET OF "BOILER HOUSE ECONOMY AND CHEAP STEAM" PAMPHLETS TO

G. H. TOD, 213 Manning Chambers Queen Street West **TORONTO**

Perolin

FOR BOILERS

A Metal, not a Water Treatment

PEROLIN is a heavy viscous liquid that separates scale from the metal surface to the water MECHANICALLY, not from the water to the metal CHEMICALLY. Positively prevents further incrustation, corrosion, pitting or foaming.

This is a strong claim, BUT WE PROVE IT in your own plant AT OUR EXPENSE. CAN ANYONE DO MORE?

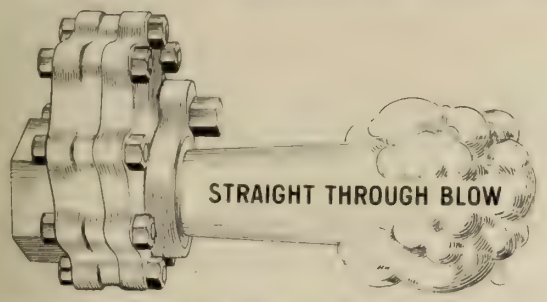
Descriptive booklet or representative will be sent to you upon request.

PEROLIN COMPANY OF CANADA, LTD.

STANDARD BANK BLDG. TORONTO

Sole Distributors for the Dominion.

EVERLASTING
BLOW-OFF VALVES



IT NEVER LEAKS!
WRITE FOR PRICES

200,000 IN USE

Does your Boiler leak, Mr. Engineer?
How often do you blow it?
The "EVERLASTING" is the only perfect blow off valve on the market.
No stuffing box—requires no packing—is self-cleaning, and has a self-grinding seat—nothing to get out of order—What's the answer?

RELIABILITY—SIMPLICITY.

SOLD AND MANUFACTURED UNDER CANADIAN PATENTS BY

Engineering Specialties Company, 1080 King St., West, TORONTO
LIMITED

AGENTS

MONTREAL, QUE.
H. L. Peiler & Co.

ST. JOHN, N.B.
The A. R. Williams Mach. Co.

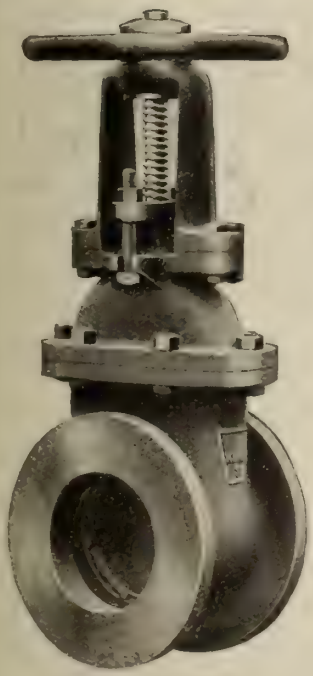
WINNIPEG, MAN.
The A. R. Williams Mach. Co.

CALGARY, ALTA.
P. D. McLaren Limited

VANCOUVER, B.C.
Taylor-Forbes Company, Limited

KERR GATE VALVES
OUTSIDE SCREW AND YOKE
"KEYSTONE" PATTERN

Embody all the latest features


4½-in. and larger

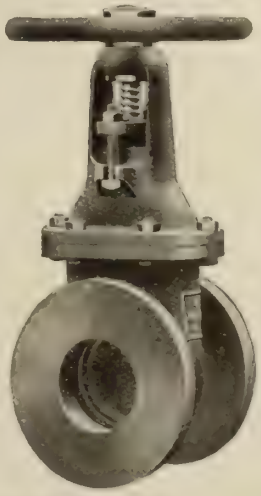
Screwed in Seats

Deep Bronze Bushed Gland and Stuffing Boxes.

Full Opening.

Large Diameter Hand-Wheels.

Solid Wedge Discs.


4-in. and smaller

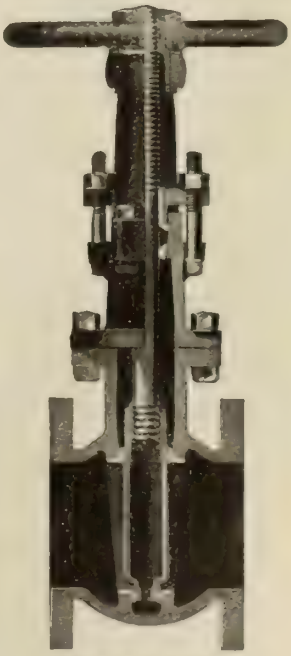
Narrow face-to-face Dimensions

Symmetrical Design.

Good Material.

Interchangeable Parts.

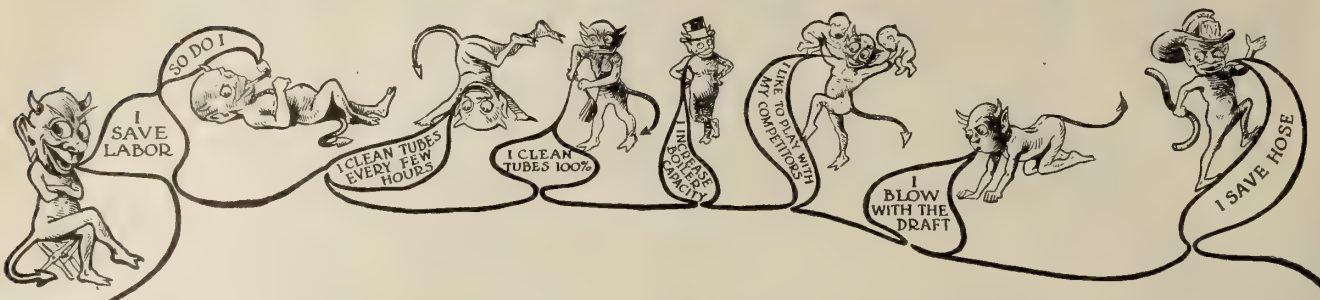
Guaranteed Tested.


4½-in and larger

The Kerr Engine Co., Limited, MANUFACTURERS
Walkerville, Ontario

The advertiser would like to know where you saw his advertisement—tell him.

THE VULCAN IMPS


I SAVE LABOR
SO DO I
I CLEAN TUBES EVERY FEW HOURS
I CLEAN TUBES 100%
I INCREASE BOILER CAPACITY
I LIKE TO PLAY WITH MY COMPETITORS
I BLOW WITH THE DRAFT
I SAVE HOSE

"And We All Save Coal"

Wherever the **VULCAN SOOT CLEANER IMPS** are allowed to work they raise the Devil—the Soot Devil. They juggle the heat units and make two units grow where one unit grew before. They make slow steaming boilers "pop" for the first time in years. They give many a weary engineer and fireman a chance to rest. The IMPS are always on the job, "they work while you sleep." They cut out lost time, trouble and repairs. They are good for the operating man and mighty good for the boiler owner. Don't let Soot, the expense maker, worry you longer. Fill out the coupon, mail it now, and we'll send you our Free Booklet, "Economical Steam Production," which shows how the Vulcan removes Soot, and saves from 5 to 15% in fuel.

Mail the Coupon

Vulcan Tube Cleaning Systems,
LIMITED

42 Craig St. West **MONTREAL**

SIGN, TEAR OUT AND MAIL

P.H. 10-12. Date.....

VULCAN TUBE CLEANING SYSTEMS, LIMITED, Montreal.

Please send me, without charge, your book—ECONOMICAL STEAM PRODUCTION, and your proposition.

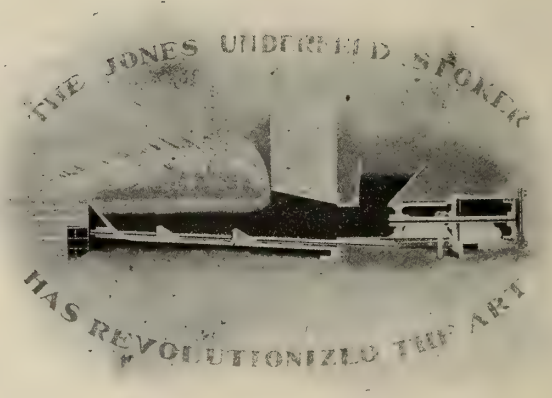
(It is important that following information be given in full.)

WATER TUBE BOILERS. Number.....Type.....
Pressure .....Horsepower .....No. Tubes H
(except on Stirling boiler .....Any Superheaters .....Width of alley space at side .....
TUBULAR BOILERS. Number.....Horizontal or Vertical .....
Name .....
Address .....

Power Plant Economy Must Begin In The Boiler Room

If the fuel loss is not checked **there**, your engine room results count for little. The little leaks and wastes that get your attention in the engine room are insignificant to the **preventable** waste under your boilers.

The Jones Underfeed Stoker



Is a big paying investment in the small plant. It is a bigger paying investment in the bigger plant.

Fuel saving from 10 to 25% interests you. That's what hundreds of Jones Stokers are doing to-day in plants like your own.

Your plant is not an exception. You need a Jones Stoker under every boiler you've got.

We will redesign your furnace, put in a **Jones Stoker** and show you. Write us!

How It Operates

Coal is placed in the hopper and automatically pushed into the green fuel bed under the fire, where it is subjected to a coking effect until it in its turn is forced to the top. Each charge of fuel causes a backward and upward movement that keeps the top of the fire, which is nearest the boiler, constantly agitated without opening fire doors. Air for combustion is admitted between the green fuel and the fire bed. The steam pressure itself automatically controls the fuel and air supply, proportioning them to each other and to varying loads in just the correct amount to obtain the most complete combustion possible from any grade of bituminous coal. As grates form no part of the Jones System, loss of fuel through grate bars is impossible. As combustion is commercially complete and air supply is correct, economy results and incidentally the smoke nuisance is effectively eliminated.

Jones Underfeed Stoker Co., Limited

National Trust Building :: TORONTO

The Murphy Automatic Smokeless Furnace

C. H. HUSSEY - COPPER ROLLERS - PITTSBURGH, PA.

Had 10 HT boilers—each 100 H.P.—operated 24 hours per day; two shifts of firemen—seven men each shift; they installed three water-tube boilers—each 333 H.P.—and equipped them with MURPHY AUTOMATIC SMOKELESS FURNACES, and **with this equipment carry the load using two boiler units, one man each shift!**

ECONOMY in coal is .....27 per cent.
SAVING in labor .....six firemen each shift

The saving in labor alone is good dividend earning power on money investment.

For printed matter address:

MURPHY IRON WORKS, DETROIT, MICH. BUFFALO, N. Y.

FULTON WATER-COOLED MECHANICAL STOKER

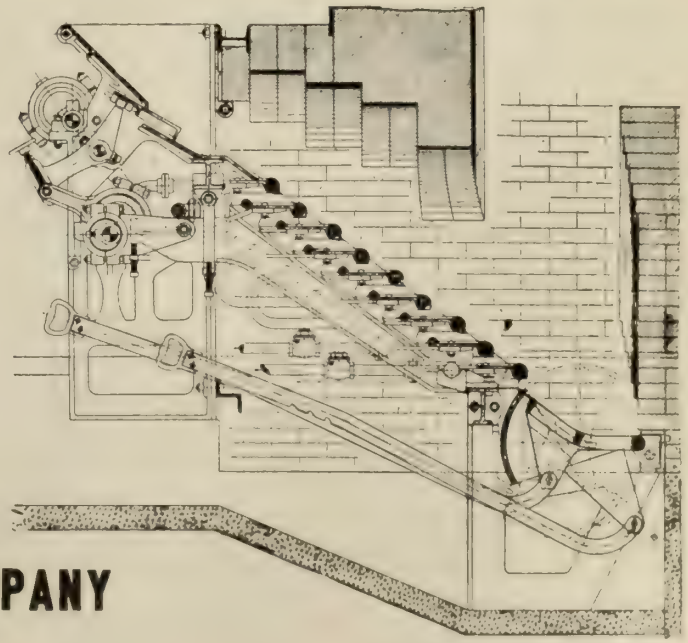
It is Water Cooled.

Repairs Almost Eliminated.

Natural Draft only, but 100% overload easily secured.

Smokeless, in Operation 70-78% Efficiency Obtainable.

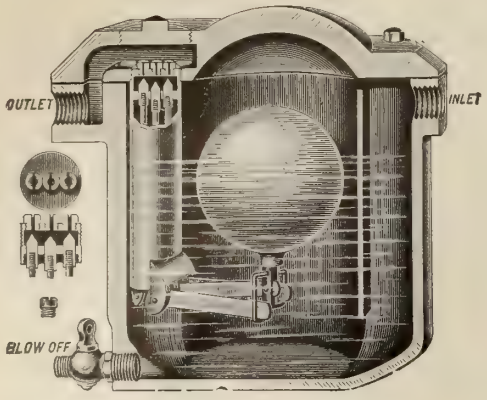
Write for Further Particulars.



THE
HARE ENGINEERING COMPANY
Limited

14-16 King Street East TORONTO, ONT.

The advertiser would like to know where you saw his advertisement—tell him.



Wright
"Emergency" High Pressure Continual Flow Steam Trap

THREE VALVES

GREAT CAPACITY

Keeps the steam line automatically and continually drained of accumulating condensation.
Shipped subject to trial and return if results are not satisfactory.
Send for Catalog.

DARLING BROS., Limited
15 Ottawa Street, MONTREAL
TORONTO WINNIPEG ST. JOHN, N.B.

Marsh Steam Pump

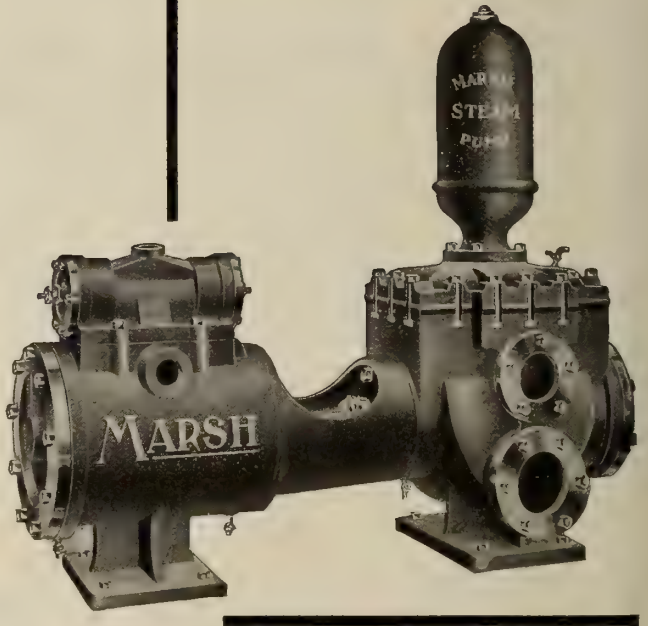
The Pump with the Self-governing Steam Valve

Note the extreme simplicity in construction and the absence of outside valve motion. There is practically nothing to get out of order. Nearly all the wearing parts are made of phosphor bronze instead of common brass, including piston rod, water cylinder lining and valve seats.

The steam valve is self-governing and admits only just enough steam to do the required work. The pump cannot short-stroke, race or pound under the most severe conditions.

115,000 in successful operation.

Ask for Catalog No. 18

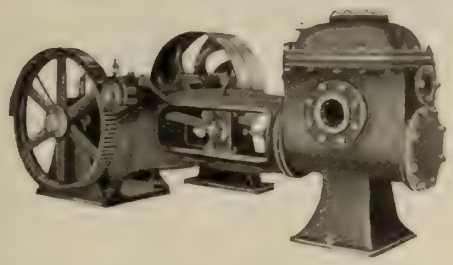


American Steam Pump Company
BATTLE CREEK - - - MICH.

CANADIAN AGENTS

A. R. Williams Machinery Co., Toronto
Williams & Wilson, Montreal
London Engines Supplies Co., London, Ont.
Stuart Machinery Co., Winnipeg
Hallman Machinery Co , Vancouver, B. C.
Mechanics' Supply Co., Quebec, Que.
Gorman, Clancey & Grindley, Limited
Edmonton & Calgary

STEAM and POWER PUMPS, CONDENSERS, TRAVELLING CRANES



The SMART-TURNER MACHINE CO., Limited
Hamilton Canada

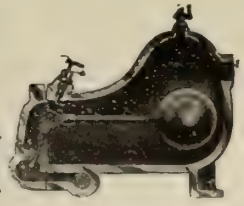
McDANIEL IMPROVED STEAM TRAP

FOR HIGH OR LOW PRESSURE.

Steam can't blow through. They have large discharge valves and cannot be flooded from sudden flushes of water.

MAY WE SEND ONE FOR TRIAL?

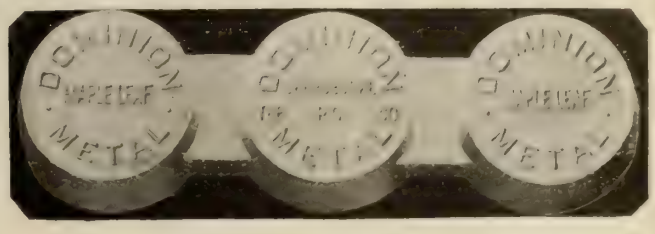
Reducing Valves, Pump Governors, Relief Valves, Exhaust Pipe Heads, Ejectors and Steam Separators. SEND FOR CATALOGUE.



THE GARTH COMPANY
26 Craig St. MONTREAL, CAN.
WATSON & McDANIEL CO.,
No. 146 N. 7th St. PHILADELPHIA, Pa.

PRICHARD'S BABBITTS
ARE
SOLD ON MERIT

They are designed to meet modern machinery conditions.



They are all COPPER-TIN-TOUGHENED, are DROSS FREE, and are made from the purest Metals obtainable.

We want you to know the following of our Brands:

PRICHARD'S EAGLE GENUINE
PRICHARD'S MACHINERY SPECIAL
PRICHARD'S METALLIC PACKING
PRICHARD'S MAPLE LEAF

They represent the best that can be made, for **High Speed, Heavy Pressure,** or **General Purpose** use. We make Babbitt Metal ONLY—and we make it specially for any place in which it can properly be used.

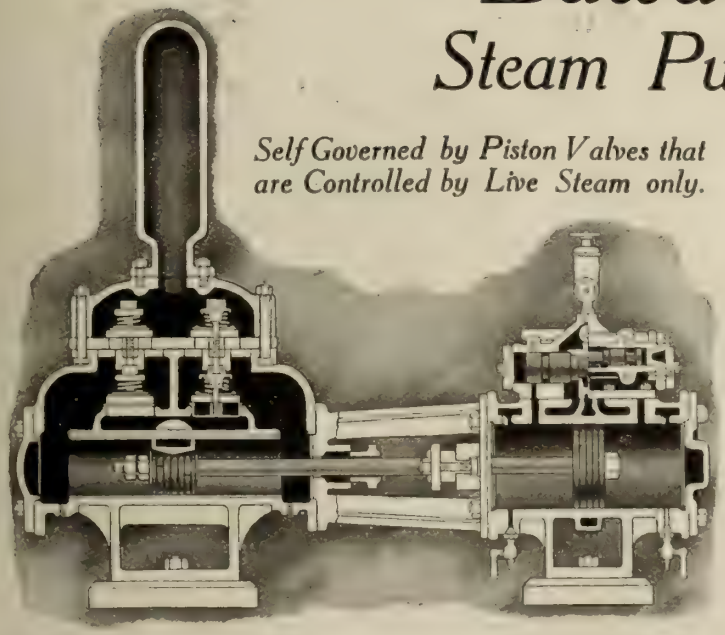
Our PRICES ARE ROCK BOTTOM, and are named F.O.B. your nearest RAILWAY STATION. Descriptive Catalogue and Prices on request.

MANUFACTURED BY
The DOMINION METAL COMPANY
N. B. PRICHARD, Prop.
SHERBROOKE, P. Q.

Montreal Selling Agents
Foss & Hill Machinery Co., 344 St. James Street, Montreal

Bawden
Steam Pumps

Self Governed by Piston Valves that are Controlled by Live Steam only.



No Tappets
No Internal Tubes
No Internal Stuffing Glands
No External Valve Gears, Levers or Springs

Simple and Compound
For all Purposes

Simple throughout due to the absence of all outside valve motion.

Fewest number of working parts and the simplest arrangement of balanced steam moved piston valves.

Flexibility of speed without any mechanical adjustment.

Full stroke guaranteed under constant or varying loads.

Piston and valves all automatically cushioned, insuring the greatest safety in any emergency.

All faces carefully machined, not requiring heavy packing to make tight joints.

The Bawden Machine Co.
TORONTO *LIMITED*

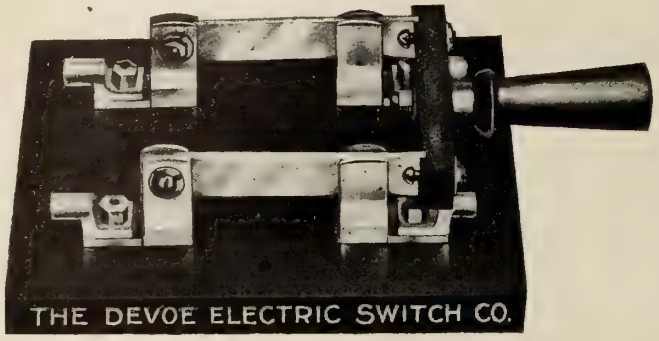
The advertiser would like to know where you saw his advertisement—tell him.

DEVOE SWITCHES

Type "C" Switches

(30-100Amp.) 125-250-440-500 Volts.

Our type "C" Switches are made of pure copper, with Standard form of bent jaws. This is a standard switch at a low price.



We also manufacture **Switchboards, Panel Boards, Steel Boxes** and **Cabinets** for every purpose.

We can ship quickly from stock.

Send us your specifications today.

Ask for catalog.

THE DEVOE ELECTRIC SWITCH CO., 157 Craig St. West, Montreal

ADANAC RED CORE RUBBER COVERED WIRES AND CABLES

Are made according to the specifications of the National Board of Fire Underwriters. The conductors are drawn from copper of the highest conductivity and are covered with two thicknesses of thoroughly vulcanized rubber compound of high quality. The wires are braided over insulation and the smooth high finish they receive makes them specially desirable for conduit work.

IMPERIAL WIRE AND CABLE COMPANY

Limited

MONTREAL

THE Northern Electric AND MANUFACTURING CO. LIMITED
Sales Agents

TORONTO REGINA WINNIPEG
CALGARY EDMONTON VANCOUVER

NEWTYPE BERGMANN LAMPS

(Tungsten Filament)

THE UNBREAKABLE KIND

Are now ready for delivery. We guarantee delivery to you in good condition.

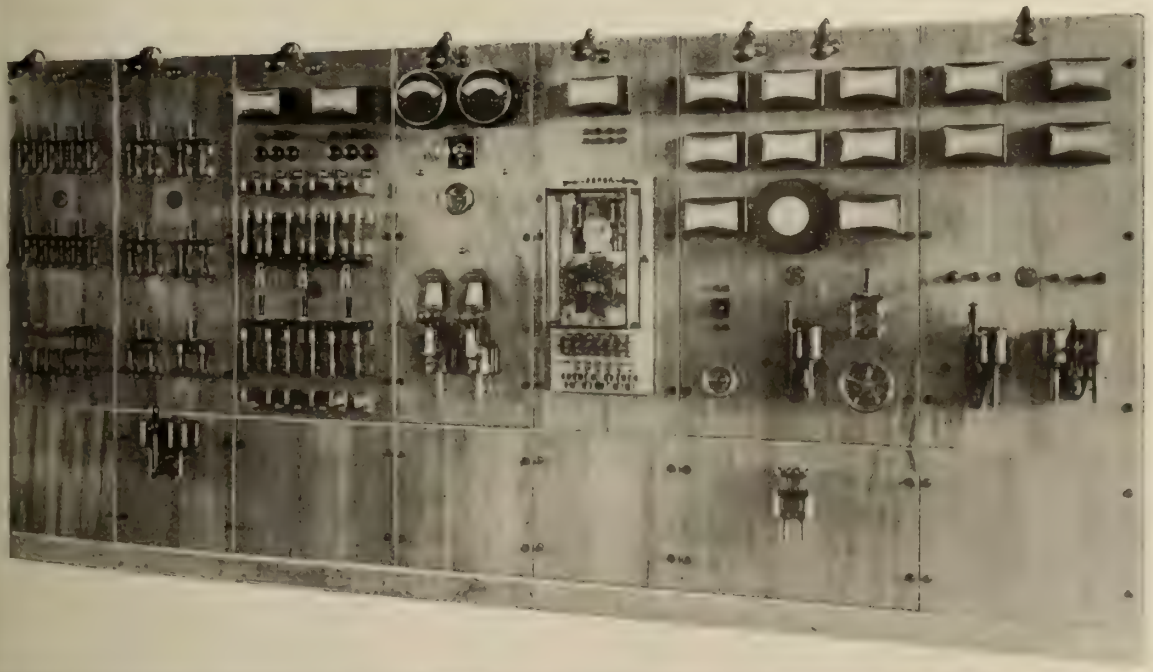
EXCLUSIVE CANADIAN DISTRIBUTOR:

P. H. KLEIN CO., Limited

Live Agents wanted all over Canada. 329 Craig Street West MONTREAL

MONARCH ELECTRIC CO., Limited

ST. LAMBERT, P.Q., District of Montreal

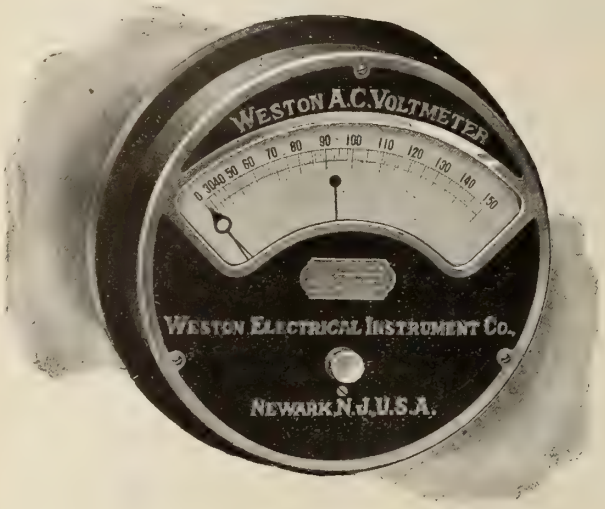


Switch Board Specialists

The advertiser would like to know where you saw his advertisement—tell him.

WESTON

Ammeters and Voltmeters



Absolute Accuracy

—is your first demand when you buy electrical measuring instruments.

You will appreciate, then, the reputation of Weston Instruments.

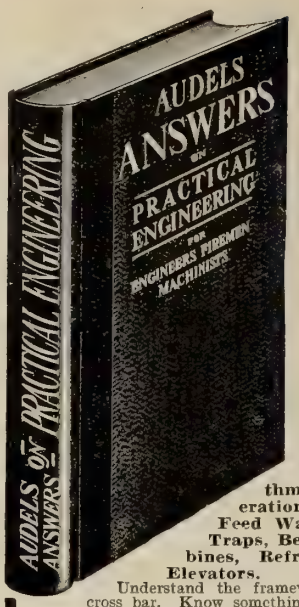
They are not affected by temperature or service conditions, but are accurate and reliable under the most severe tests.

Full information regarding Weston instruments will be sent to any address. Write our nearest house.

THE Northern Electric AND MANUFACTURING CO. LIMITED

Manufacturer and Distributor of Telephone and Fire Alarm Apparatus and Electrical Supplies for every possible need.

Montreal	Halifax	Toronto	Winnipeg
Regina	Calgary	Edmonton	Vancouver



When you spend your good hard earned money for books, always make sure that you are going to receive something that will assist you in bettering your position.

THIS book deals largely with the foundation principles which govern the practice of steam engineering. Nothing so soon condemns the applicant as want of knowledge of the every day practice and simple laws relating to the care and management of a steam plant.

No one is expected to know everything, but all are required to be familiar with certain facts which may be called "the beginning of things."

The lack of knowledge of the small things carries conviction of the same lack in the larger.

Plain facts, that you should know, are plainly explained in AUDELS ANSWERS ON PRACTICAL ENGINEERING, answers your questions on

Air, Water, Steam, Fuel and Heat, Steam Boilers, Boiler Construction, Water Tube Boilers, The Steam Gauge, The Safety Valve, Properties of Steam, Installation of Boilers, Management of Boilers, Engineers' Law, Firemen's Law, Steam Engines, The Valve and Valve Gear, The Corliss Engine, Engine Arithmetic, Lubricators, Installation and Operation of Engines, Steam Pumps, Injectors, Feed Water Heaters, Steam Heating, Steam Traps, Belts, Gears and Pulleys, Steam Turbines, Refrigeration, Practical Electricity, Elevators.

Understand the framework of which your work is but a cross bar. Know something of the cause of which your work is but an effect. Know something of the effect of which your work is the cause. And, above all, know why it is done one way and not another.

EARN THE THEORY UNDERLYING THE WORK

PRACTICAL ENGINEERING contains 288 pages fully illustrated, handsomely bound and printed, and is in every way a first class book.

FREE EXAMINATION

Sign and mail the coupon, and it will bring to your plant a book of sterling merit, for free examination. You can have one week in which to dig out the mine of valuable information contained in its 200 or more pages.

THEO. AUDEL & CO., 72 5th Ave., NEW YORK

Please send me for examination one copy Audels Answers on Practical Engineering $1

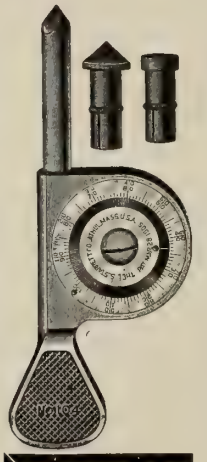
If I keep the book, I promise to send you within 7 days after receiving it ONE DOLLAR in full payment; If I do not keep it, I will mail it back to you within 7 days.

Signature .....

Occupation .....

Address .....Power House

H-P=PLAN/33,000



You can compute P from your indicator card, you know L and can figure A, but how do you find N? The surest way on a high speed or a slow speed engine, is to use a

Starrett Speed Indicator

It registers any speed without heating of parts. Equally good for motors, gas engines, line shafting or any revolving machine-part. Rubber tips for centered or pointed shafts. For sale at all hardware stores.

Get the Starrett Catalog No. 19 C D. It shows other tools for the engineer.

The L. S. Starrett Co.

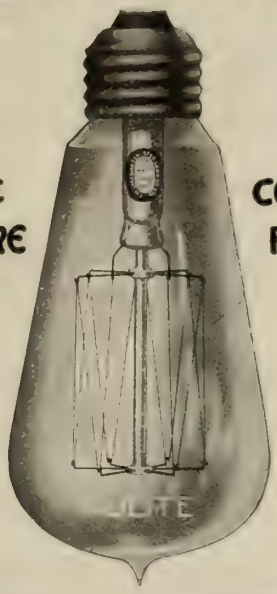
Athol, Mass.

NEW YORK 150 Chambers Street **LONDON** 36 & 37 Upper Thames Street, E.C. **CHICAGO** 17 No. Jefferson Street 42-69

"NULITE"

TUNGSTEN LAMP

GENUINE DRAWN WIRE



CONTINUOUS FILAMENT

THE LAMP WITH A RECORD

NULITE Tungstens are manufactured with one object always in view, and that is to excel. It is now in such a state that the only fitting term to express its quality is,

"NULITE the Acme of Perfection"

NULITE Tungstens are as perfect as scientific research and the most modern equipped factory on the continent can make them.

Our testing and experimental laboratory, together with the latest and highly improved machinery, enable us to offer our agents the most perfect drawn wire continuous filament Tungsten Lamp on the market.

Quality is the "forward" which has built our factory, the largest of its kind in the Dominion of Canada.

We know that we have the best. We would like you to know the same.

Send us your order, we want it, and we will guarantee perfect satisfaction.

NULITE A Canadian Product Manufactured by

The Canadian Tungsten Lamp Co., Ltd.

HAMILTON ONTARIO

Branch Warehouses: Montreal—246 Craig St. W. Winnipeg—56 Albert St. Vancouver—365 Water St.

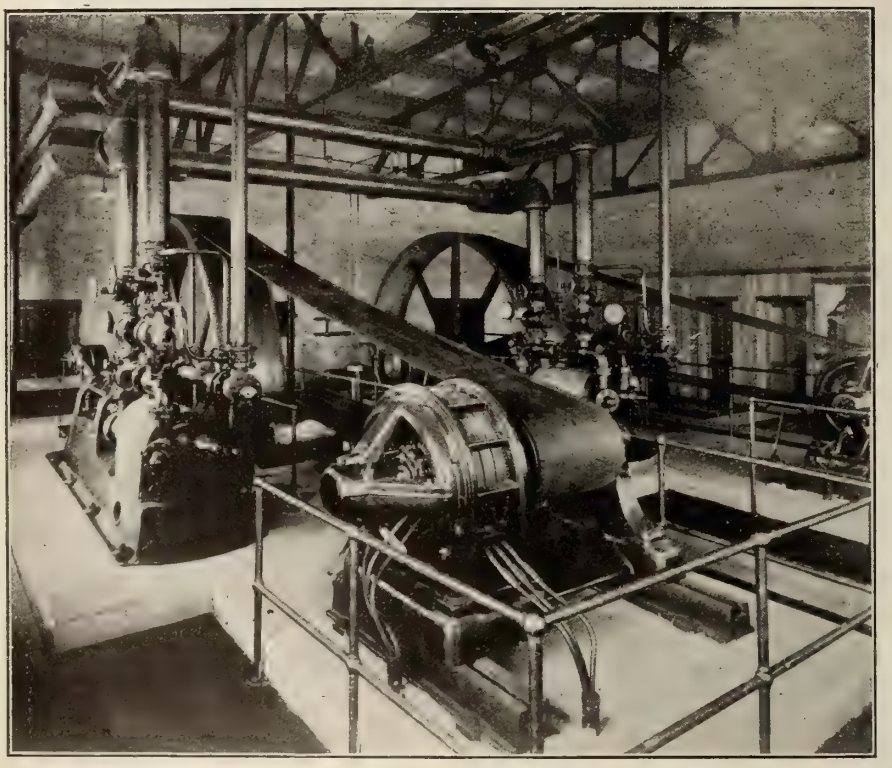
Agencies: T. McAvity & Sons, St. John, N.B. Farquhar Bros., Ltd., Halifax, N.S. Mechanics' Supply Co., Quebec, Que. Dominion Illuminating Co., Ltd., Toronto, Ont.

"THE LINDE"

REFRIGERATING and ICE-MAKING MACHINERY

CORK INSULATION

Over 8,000 Machines in use. Established and Manufacturing in Canada for 16 years.



Two 100-ton "Linde" Belt Drivers, Double Acting, Horizontal Ammonia Compressors Manufactured and Installed by us in Canada.

Recent Orders: –

IMPERIAL BREWING CO., (3 orders), Kamloops, B.C.
WM. CLARK, LTD., Montreal, Que.
MR. J. A. PATRICK, New Westminster, B.C.
C.P.R. VANCOUVER HOTEL, Vancouver, B.C.
MATTHEWS-LAING, LTD., Fort William, Ont.
CARSON'S HYGIENIC DAIRY CO., Winnipeg, Man.
ST. THOMAS PACKING CO., St. Thomas, Ont.
MONTREAL GENERAL HOSPITAL, Montreal, P.Q.
OTTAWA UNIVERSITY, Ottawa, Ont.
WM. DAVIES CO., Winnipeg, Man.
CANADIAN NATIONAL EXHIBITION, Toronto, Ont.
McGILL UNIVERSITY, Montreal, P.Q.
G.T.P. FORT GARRY HOTEL, Winnipeg, Man.
C.P.R. ALGONQUIN HOTEL, St. Andrews, N.B.
AND MANY OTHERS.

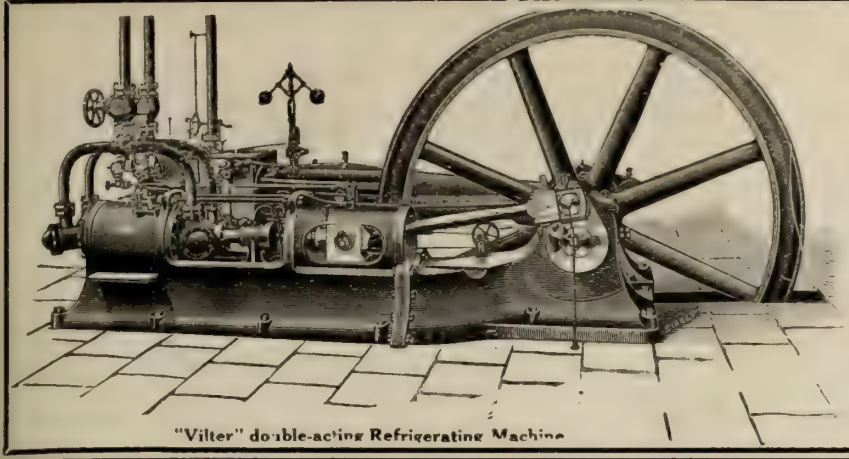
The Linde Canadian Refrigeration Co.,

Limited

37 ST. PETER STREET, MONTREAL

Branch Offices—Toronto, Imperial Building, Adelaide St.; Winnipeg, 909½ Main Street; Vancouver, Anderson & Miskin, Imperial Block, Seymour and Pender Streets; Edmonton, Walker & Barnes, 562 Second Street; Calgary, General Supplies Limited, 1233 2nd Street East.

The advertiser would like to know where you saw his advertisement—tell him.



"Vilter" double-acting Refrigerating Machine

Established 1867

The VILTER MFG. CO.

242 Becher St. Milwaukee, Wis.

BUILDERS OF HIGH-GRADE

CORLISS ENGINES

ICE AND REFRIGERATING MACHINERY

any size and for any purpose, complete line Ammonia Fittings, Condensers, Brine Coolers, etc.

Write for Catalogue and full Particulars

The

LINDE BRITISH

Refrigeration Co. Limited

¶ Numerous fully authenticated laboratory tests organized from time to time in America and Europe, have invariably served to demonstrate in an unanswerable manner, the very remarkable degree of mechanical efficiency to which our products have been brought. *The history of mechanical refrigeration is our history.*

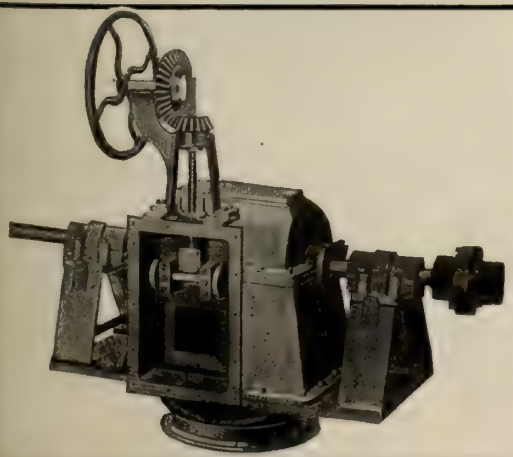
Head Office: LONDON, ENG.

BIRMINGHAM	GLASGOW	JOHANNESBURG, S.A.
BRISTOL	BOMBAY	SYDNEY, N.S.W.
LIVERPOOL	CALCUTTA	PORT NAPIER, N.Z.

CANADIAN OFFICES

CORISTINE BLDG

MONTREAL



Little Giant Water Turbine

Self-contained Unit

Mounted on vertical or horizontal shafts. Gate consists of single casting, and is trouble proof. Adapted for all heads. Highest efficiency guaranteed.

Write for Catalog. Prices will Interest You.

J. C. WILSON & CO.

Founders and Machinists. GLENORA, ONT.

The advertiser would like to know where you saw his advertisement—tell him.

J. V. Jamison, President. T. B. South, Vice-President. J. V. Jamison, Jr., Treasurer.

This "Ad" is addressed to users of

Refrigerator Doors, Windows and Ice Chutes

— in Canada —

for Cold Storage, Meat, Fish, Dairy, Poultry, Fruit and Vegetable products.

We guarantee our Doors not to sag or stick in the frames.

Our Hardware weighs 60 lbs. to set.

We manufacture or sell nothing else.

Our entire time and forces are directed to this line.

We supply

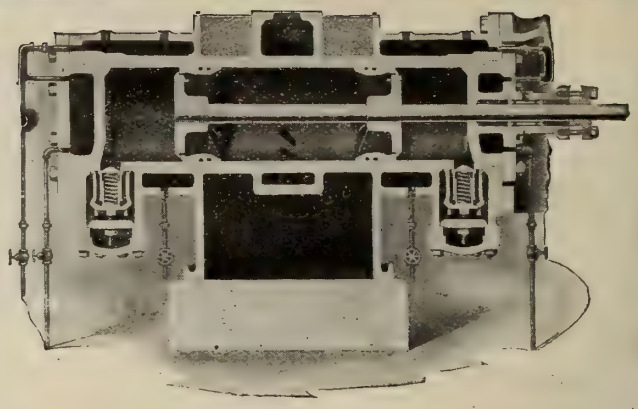
Linde British Refrigeration Co.
Linde Canadian Refrigeration Co. of Canada.
Armour & Co., Chicago, Ill., U.S.
Swift & Co., Chicago, Ill., U.S.

with all they use. Our latest orders are to Swift & Co., for Toronto, Can., 30 Doors; Canadian Fish and Cold Storage Co., Prince Rupert, B.C., 110 Doors.

Send for Catalogue

Jones Cold Store Door Co.

HAGERSTOWN, MARYLAND, U.S.A.



Section Through Arctic Compressor

Raw Water Ice On The Arctic - Pownall System

is the practical, positive method to reduce your ice-making cost.

The Arctic is the only ice machine on earth whose suction valve is absolutely without spring, bolt or nut to work loose. And our raw water freezing system is as simple and dependable as our compressor itself.

Get Arctic bulletins and proposition on your needs—no obligation involved.

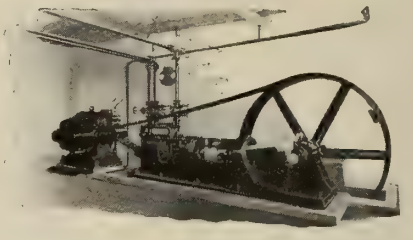
"We Do It Right."

The Arctic Ice Machine Company

Canton, Ohio, U.S.A.

THE SIMPLE SERVICEABLE SAFETY

Ice and Refrigerating Machines



THE COMING AMMONIA COMPRESSOR

THE "SAFETY"

Built by

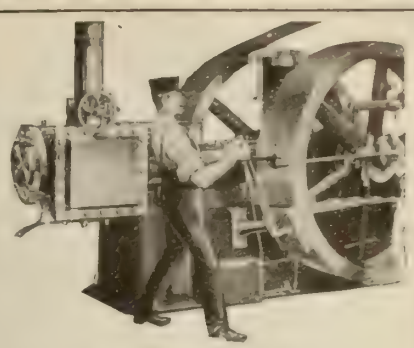
The HUETTEMAN & CRAMER CO.

DETROIT, MICH.

Complete Ice Making and Refrigerating Plants for every conceivable purpose.

SIX OF THESE "SAFETY" INSTALLATIONS TO DATE IN ONTARIO THIS SEASON

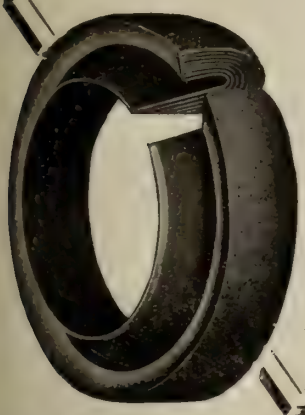
STOP Running Your Engine With A Brake Applied!



You are literally running your engine with a brake constantly applied if you are using soft packings in the stuffing box. Because in order to prevent leakage with soft packings the gland must be kept screwed up tight—causing a constant pressure of friction against the rod. This friction not only quickly wears out the packing, but scores the rod, **increases your fuel bill and decreases the efficiency of your engine.**

You can reduce this rod friction at least 75% by using

J-M SEA RINGS



The operation of these rings is entirely automatic. They are so constructed that their pressure against the rod is always in exact proportion to the pressure exerted on them by the steam or contents of the cylinder. When there is no pressure from the cylinder on the packing, **there is no pressure of J-M Sea Rings against the rod.** Any pressure on J-M Sea Rings is thrown against the "lip" of the packing, and this lip is forced against the rod with a corresponding force —just sufficient to prevent leakage past the packing.

J-M Sea Rings eliminate unnecessary wear on themselves and on the rod, effecting a direct saving in fuel formerly required to overcome this friction.

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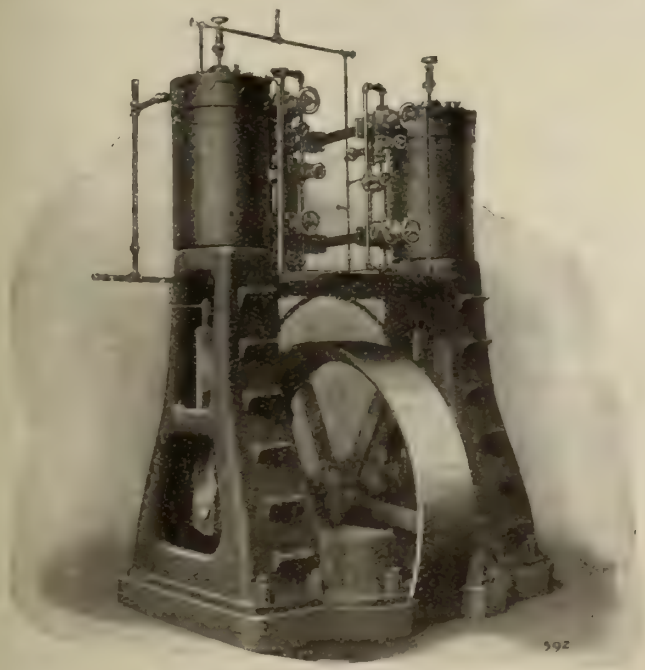

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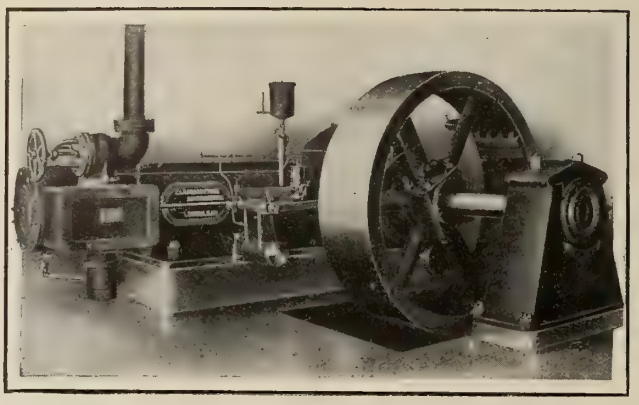

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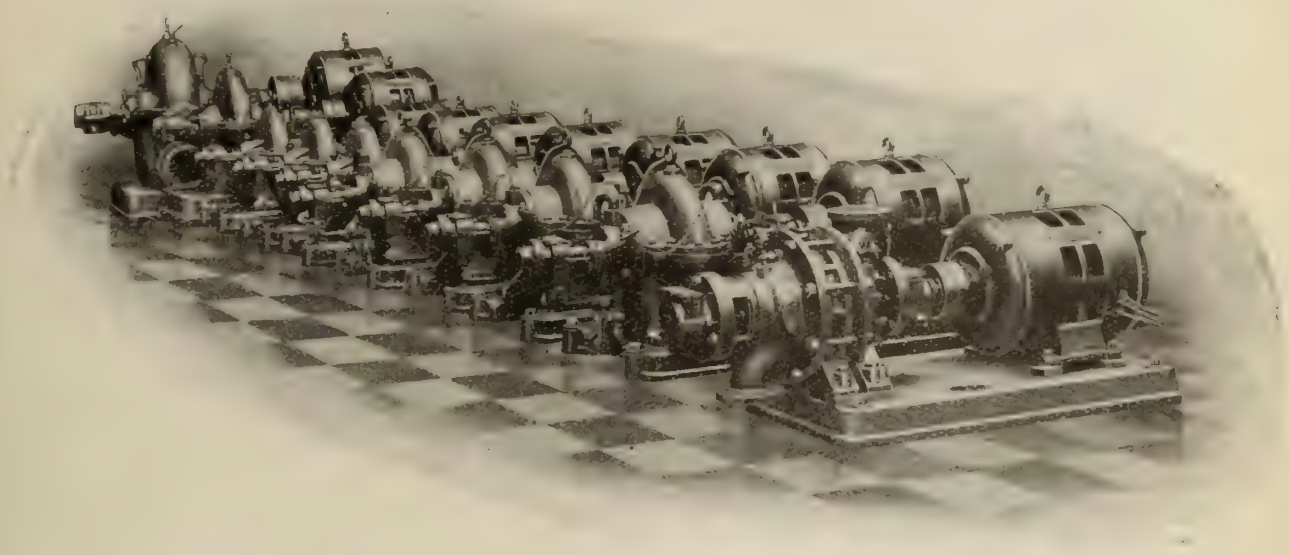

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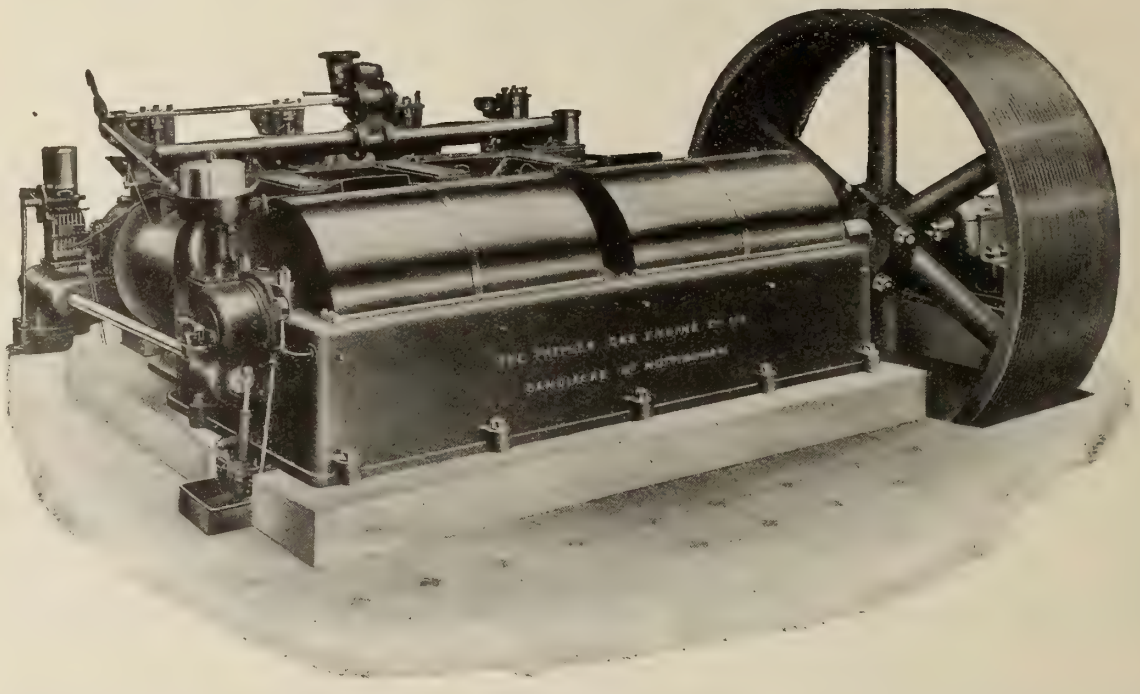

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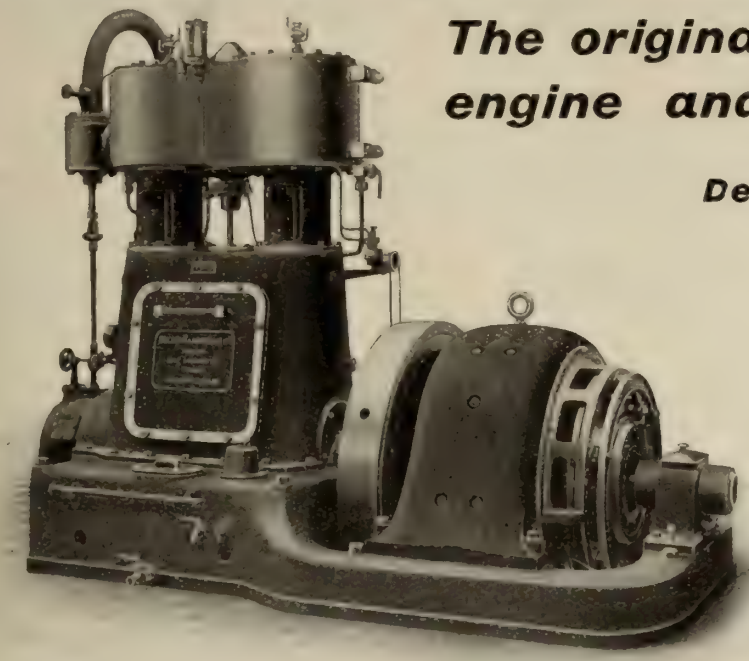

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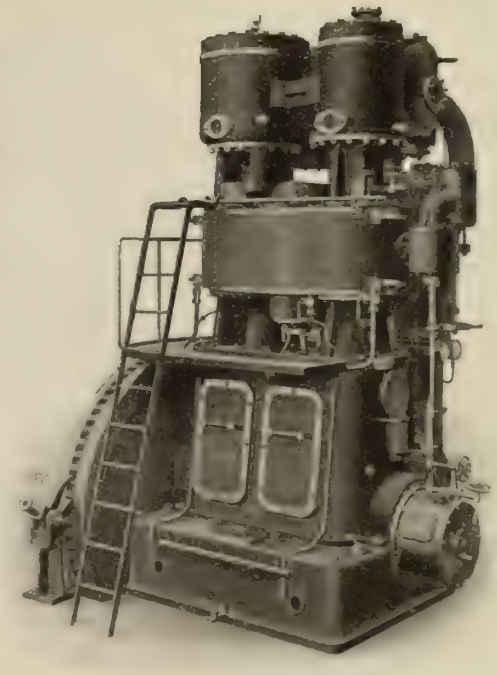

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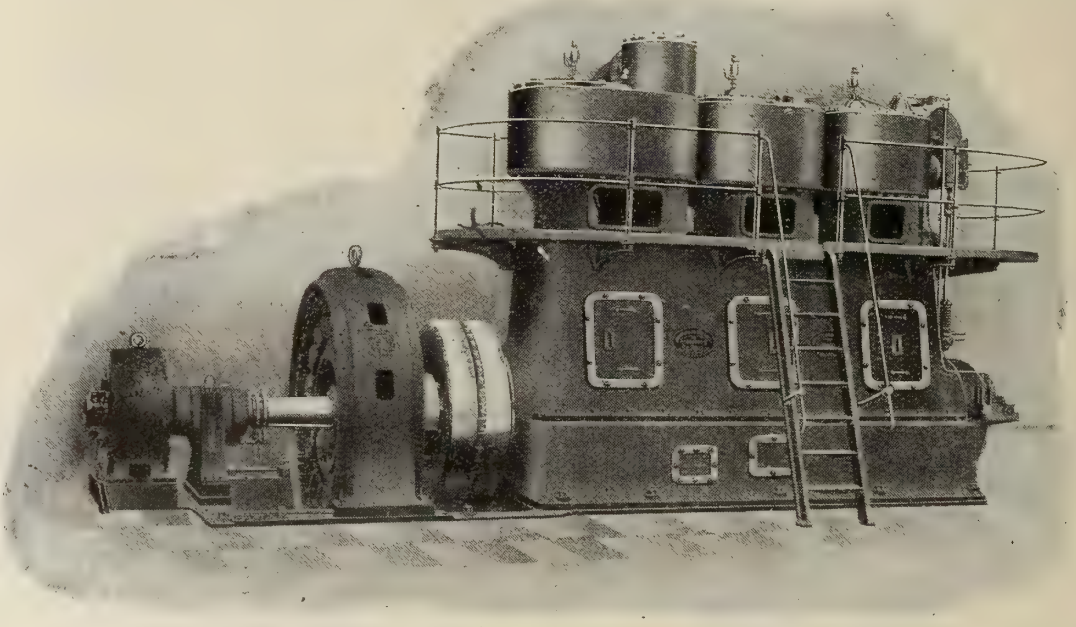

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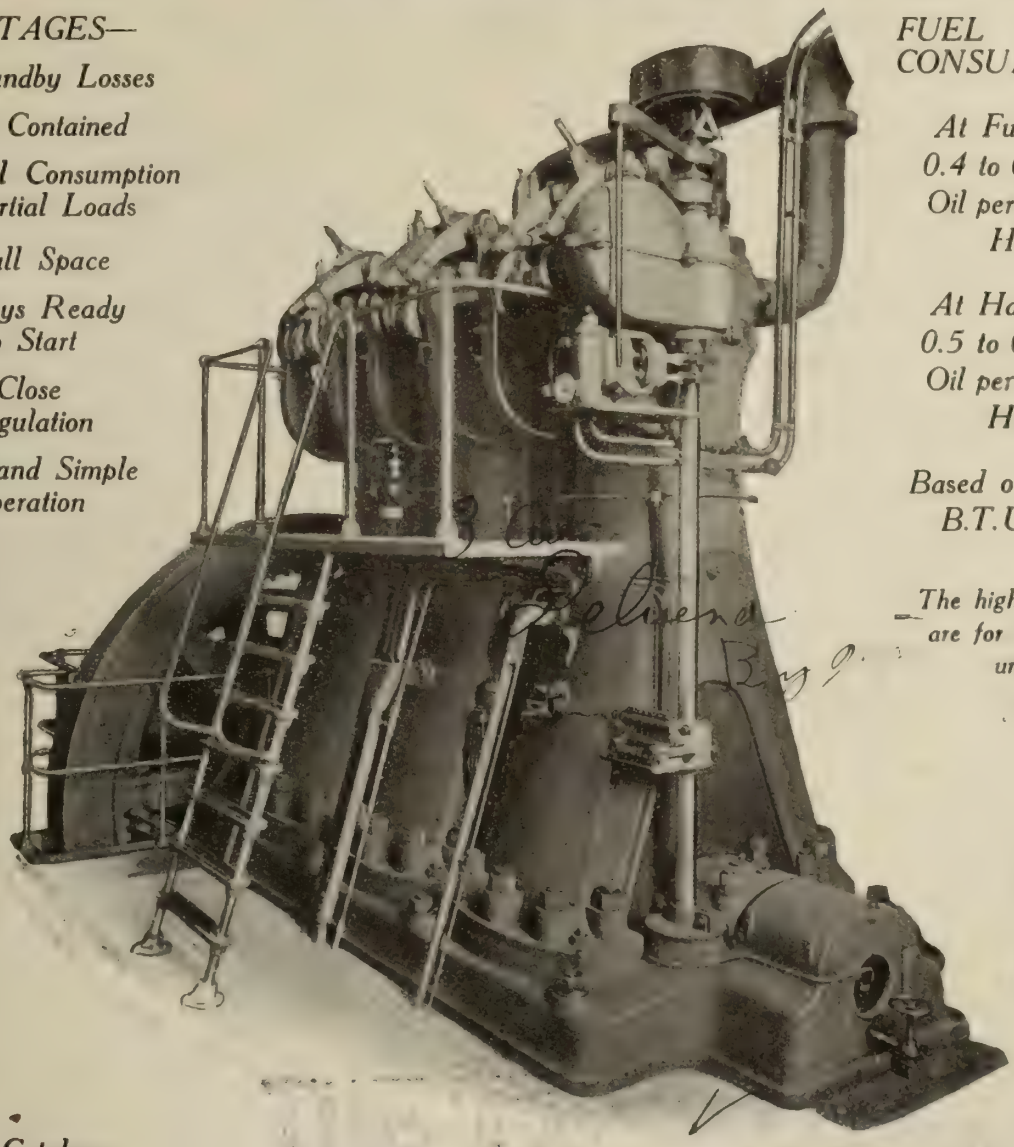

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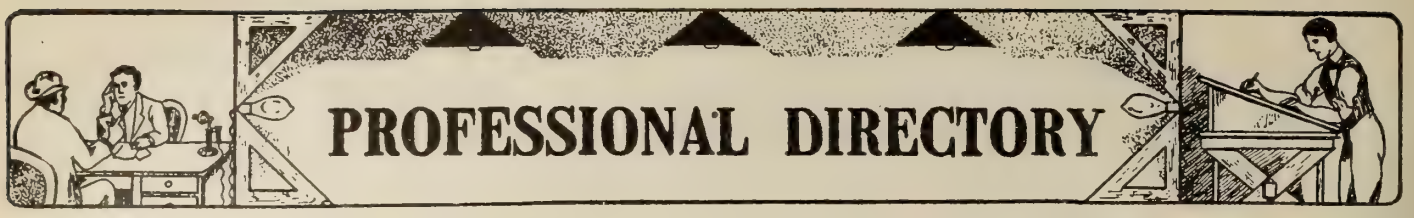

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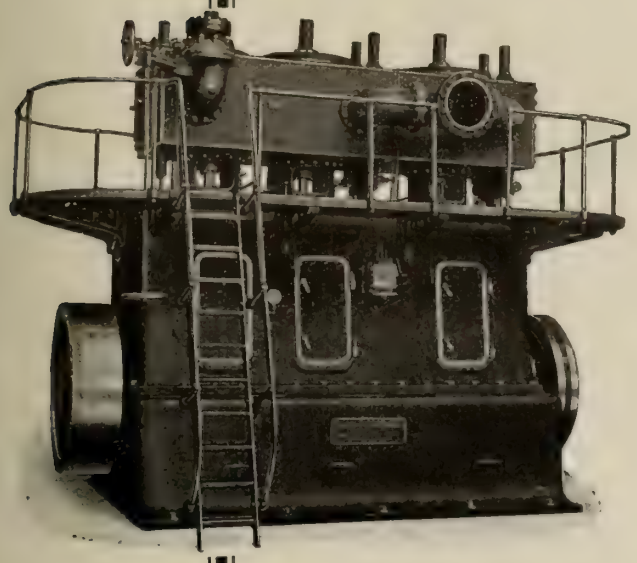
The machines in your power house, whether a central station, isolated plant or factory, are to last a life time—they should be the best you can buy. You won't have confidence in them unless they are the best.

Your Engine—you have no confidence in a new, freak design—you want one of tried service. The



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is not a radically different construction, but a well-designed, finely-built Engine having many thoroughly tried features of marine practice adapted to electrical service and stationary work.

Robb Vertical Compound Engines

are short stroke and of the high speed for direct connection to generators, turbine pumps, fans, etc. They are entirely enclosed and self-lubricating—in short have all those features which contribute to Robb service.

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Will give you as they are giving others wherever installed

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At a Minimum Cost of Upkeep

These Engines have a Perfect System of forced Lubrication.

They require little or no attention while running.

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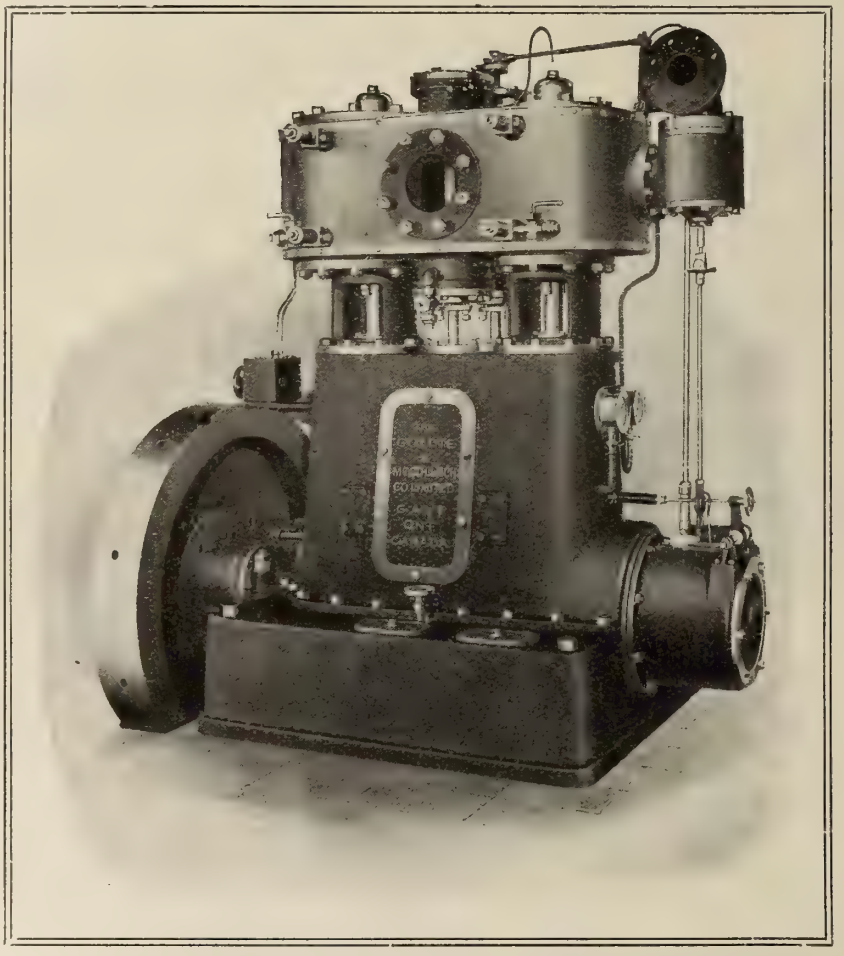

They run with Practically no Noise or Vibration.

All working parts are very easy of Access.

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Refrigeration Equipment of Gunns Limited, West Toronto

By Chas. W. Byers

The problems met in providing cold storage for a big beef and pork packing plant are quite different to those encountered, say, in an ice cream factory, and sometimes necessitate a modification of methods and equipment. The writer of this article saw several unique conditions at the plant of Gunn's, Ltd., and has made special mention of them.

GUNN'S, LTD., of West Toronto, are one of the large beef and pork packing firms of Ontario, and have branches in Montreal, St. John, N.B., Walkerton, and other cities. The firm was started in 1874 by Donald Gunn, who opened up a produce business at 78 Front Street, Toronto. These still take care of the firm's city trade.

The plant is situated in West Toronto, and is an ever-growing concern. They have just opened up one of the finest fresh meat branches in Canada at the St. Lawrence Market, Toronto. An article descriptive of this appears in our February issue. The business extends all over the Dominion, Newfoundland, Great Britain, and to certain States of the Union. They were the owners of the first cotton seed oil refinery erected in Canada, and are manufacturers of fertilizers. The capacity of the plant is 5,000 bags and 1,000 cattle a week besides the sheep, lamb, and calves.

The president is Mr. John A. Gunn, of Gunn, Langlois & Co., Montreal; vice-president, Mr. Hector Gunn; general manager, Mr. F. M. Moffat, and general sales manager, Mr. A. C. MacVicar.

Refrigeration Equipment.

The part of this plant of interest to readers of this magazine is the power house. There are three ammonia compressors. Two of these are double acting 75-ton machines, installed by the Linde-British Refrigeration Co., six years ago. These are run on the wet compression system, and are operated on a double pipe condenser situated on the roof. These two Linde compressors are operated by Wheelock engines, manufactured by the Goldie & McCulloch Co., Ltd., Galt, Ont. A 125-ton York machine has recently been installed, which has given opportunity for the two 75-ton machines to be thoroughly overhauled. This was not possible previously, as the plant was expanding so rapidly, and these two machines were in continuous service. The diameter of the steam cylinders of these units is 16 inches, the stroke 38 inches, and the boiler pressure 110 lbs. The diameter of the ammonia cylinders is 15 inches.

125-Ton York Machine.

The foregoing machines, with a couple of small air compressors, comfortably fill a power house of considerable size. The height of the engine room is around 20 feet, which gives ample space for the piping system. An addition has been built adjacent to this one, to house the new compressor and a double pipe condenser. The former, as has been stated, was manufactured by the York Manufacturing Co., and was supplied by the Kent Co., Ltd., of Montreal. This ma-

FIG. 2.—BATTERY OF RETURN TUBULAR BOILERS

FIG. 1.—GENERAL VIEW OF THE PLANT OF GUNN'S, LTD., WEST TORONTO.

chine was installed during the fall of last year. It runs on the dry compression system, is of 125 tons capacity, and is driven by a Canadian General Electric 250 h.p. motor at a voltage of 2,200. It has a stroke of 40 inches, and generally operates on the double pipe condenser, which stands by its side. The power is supplied for this motor and all others on the Gunn plant by the International Power Co.

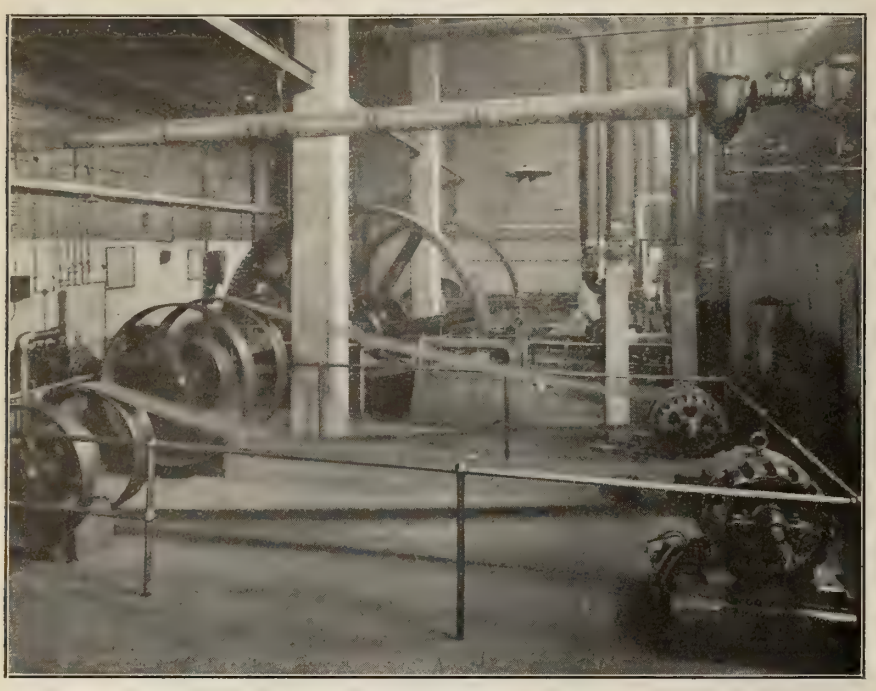


FIG 3.—MOTOR-DRIVEN AIR COMPRESSORS AND STEAM-DRIVEN LINDE AMMONIA COMPR ESSORS.

The Cooling Rooms.

From the header, pipes take off in every direction to cooling rooms, some of one temperature and some another. These expansion pipes are operated on the direct system. On the ground floor are several freezers for offal. Two-inch pipes are used on all the walls, and there is a double set in the ceiling. The temperature in these rooms ranges between zero and six above. In the butter room, where are also stored fowl and turkeys, the temperature is 12 deg. above.

In four hog rooms the temperature stood around 33 degs., and in the lamb room 34 degs. The carcasses were suspended from hooks on an iron tracking, and could be easily run to the cutting-up department. There is a hanging room for hogs where they remain until chilled off before going to the coolers. There are also two beef chill rooms, and two beef coolers. In the hog and lamb cooling rooms the cold air system is adopted. Brine is made to circulate through a series of expansion pipes, and cold air is forced through the room by means of a fan, so that it enters in the middle of the ceiling, and departs through the wall. There are over a score of rooms in the plant that are cooled by this means.

The Boiler House.

Five boilers at the rear of the compressor room provide steam necessary for the compressor, various pumps, and for the many other operations throughout the plant. One of these boilers was recently installed. It is a 300 h.p. "Erie City" water tube boiler, fitted with a Murphy stoker. All the boilers were supplied by the John Inglis Co., Toronto. Four of the boilers are of the return tubular type, 18 feet long, 72 inches diameter, 150 h.p. each, and hand fired.

The feed water for the boilers, after passing through the double pipe condenser, is fed direct to two Webster vacuum feed water heaters and purifiers by two Smart-Turner 8x5x12 duplex pumps.

In the compressor room are two air compressors of the Ingersoll-Rand type, one delivering air at 90 lbs. pressure, and the other at 25 lbs. The former is an 8x8 machine, and the latter a 10x12. They are operated by Canadian Westinghouse A.C. 20 h.p. motors. These supply the air required in the abattoir upstairs.

The Sprinkler System.

The automatic sprinkler system is of two types, dry and wet. The dry is in use in the low temperature cold storage rooms, while the wet system is used throughout the general factory. The dry system is used, because where the pipes were filled with water the latter would freeze. Instead, the sprinkler pipes are fitted with air, and when the head goes off, they fill with water.

The chief engineer is William M. McRobert, who is quite an authority on refrigeration matters.

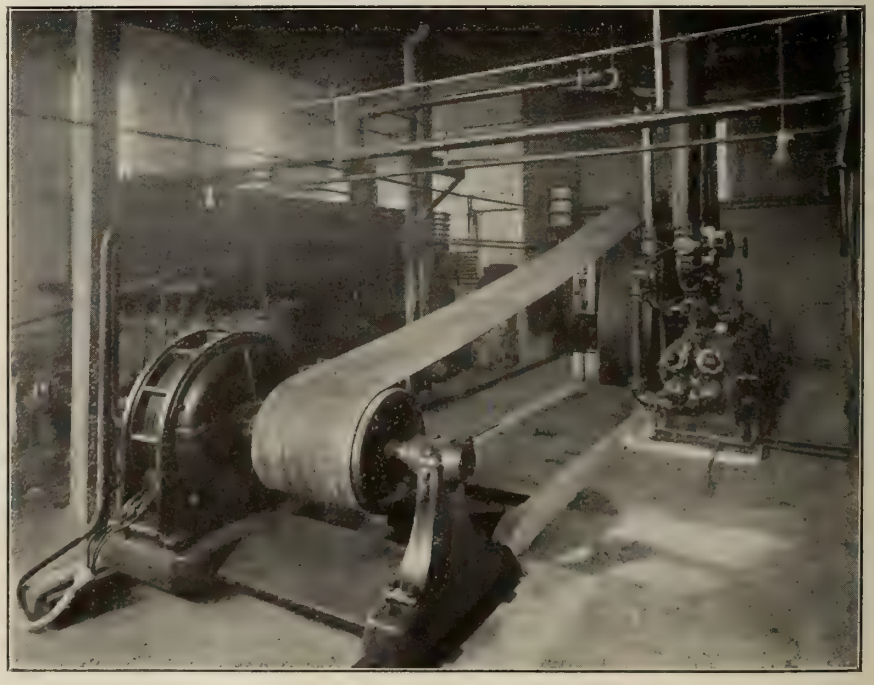


FIG. 4.—125-TON YORK MACHINE INSTALLED RECENTLY.

COMBINED SPRINKLER AND HEATING SYSTEM.

A COMBINED sprinkler and heating system is in use in a large cotton mill in New Bedford, Mass. The building, 237ft. by 300ft., has a basement and one storey, and is covered by a sawtooth roof. The sprinkler system is supplied by an 8in. pipe from the yard mains and a steam pump. In the basement the entire sprinkler system is used for heating, no other heat being provided. The sprinkler heads are of the Grinnell glass bottom type designed to melt at about 160 degrees Fahr. The

hot water has an average temperature of about 200 degrees Fahr., and at times reaches a maximum of 245 degs. Fahr.

FIG. 5.—CARCASSES SUSPENDED IN A COOLING ROOM.

According to Mr. Gorham Dana, of the National Fire Protection Association, overheating of the sprinklers is prevented by placing them in offset pipes about 12in. long and ½in. in diameter. These offsets are 3in. above the main pipe and connected to it by a ½in. elbow and nipple. It is said that the action of hot water on the iron pipe causes segregation of free nitrogen from the air in the water, and this gas collects in the space adjacent to the sprinkler heads. The gas acts as an insulator, and as there is no circulation of water through the offset pipes, such heat as reaches them by conduction is radiated into the atmosphere before it has a chance to melt the fusible caps.

UTILIZATION OF COAL.

By W. J. D.

AMONG the economic uses of coal in Nova Scotia may be mentioned:

(1)—The generation of power for mining purposes.

(2)—The coking of coal in by-product coke ovens.

(3)—The briquetting of slack coal.

(4)—The generation of electric energy at central power plants and its transmission to the surrounding collieries. This has been developed to such an extent that some of the collieries are now operated entirely by electricity. Electric cables are carried underground by means of bore-holes and the energy is used for mine haulage and pumping purposes. These plants present many new and up-to-date features such as low-pressure and high pressure steam turbo - generators and mechanical stokers for firing the boilers with low-grade slack and splint coal.

The Dominion Coal Co. has recently installed a power plant at Waterford lake in which Bettington boilers, fired with pulverized low-grade coal are used to generate steam for the turbo-generators. The boilers are the first of their kind to be installed in America.

Practically all the coke produced is made in some type of by-product oven. The Dominion Coal Co. recovers the by-products—gas, tar and ammonia. The Nova Scotia Steel and Coal Co. recovers only the gas from their coke ovens, but are considering the erection of by-product ovens. The coking of coal in by-product ovens is of importance, not only on account of the value of the by-products recovered, but also because the basis of a briquetting industry is dependent upon a supply of tar or pitch as a binder for the briquettes.

Much slack coal is now secured by mining operations in Nova Scotia, and as the higher grades of coal become less plentiful, lower-grade seams will be worked and more slack coal obtained.

There are at present, two coal briquetting plants under construction and one in operation in the above-mentioned province. The Dominion Coal Co. also has a briquetting plant under consideration, but has not yet decided where it is to be erected.

The Question of Low Grade Fuel for Motor Trucks

In the development and progress of the automobile and motor truck to date, it will be found that gasoline as the fuel has played a not inconsiderable part in the large measure of achievement attained. Its cost, however, is becoming prohibitive, and if the industry, of which these mechanisms are the product, is to extend and still further prosper, other and less costly fuels must be made available.

THE immediately available substitutes for gasoline are kerosene, distillate and naphtha.

Kerosene is exceedingly plentiful, low in cost, and uniform in quality, promises to continue in abundance, and, if demanded in large quantities for motor fuel, could be disposed of in the domestic market with greater profit to the refiner than when marketed abroad, as is so largely done at present.

Engine distillate is a product obtained from the Western crude oils after the lighter fractions have been distilled off, and, in a way, is analogous to kerosene in respect to its position in the scale of petroleum derivatives. It is less thoroughly refined, however, and at present is to be considered principally as a local product. Its practical equivalent could be produced from other asphaltic oils, such as those of Texas and Mexico.

Naphtha is as indefinite as gasoline. In its present use it is intended to embrace not only the heavier fractions that commonly are included with the gasoline distillation, but also the fractions between gasoline and kerosene, which are at present lost to the automobile fuel market. Being slightly more volatile than kerosene, and moreover free from the doubtful reputation that kerosene enjoys as a fuel, it should prove easier

to introduce—first, because the user is in no wise prejudiced against it, and, second, because its employment entails less experimental development.

In considering the comparative utility of different fuels, particularly as between gasoline and the lower-grade petroleum distillates, there is little question of thermal equivalents. Whatever difference exists is, if anything, in favor of the heavier products. Volatility, however, as expressing the ease with which the mixture may be generated, is of paramount importance. Volatility, viscosity and gravity together indicate the comparative facility with which a fuel can be reduced to the condition of a dry or wet mixture and so delivered to the engine.

Carburetion.

That a liquid cannot be carburetted by ordinary methods need not condemn it for use in the internal combustion engine, although it does exclude it from consideration as a fuel for automobiles of present construction. In this respect the carbureter is really the determining factor in fuel selection. As the values of volatility, viscosity and gravity are lowered, the fuel becomes, respectively, harder to vaporize, more difficult to force through small orifices and requires a greater lifting effect (suction) to overcome its superior mass per unit of volume. With the heavier fuels, therefore, different proportions must be employed in the carbureter in order to obtain results corresponding to those obtained in successful instruments designed for gasoline. It is evident at least that a carbureter designed for heavy fuel may be more satisfactorily operated with gasoline than a gasoline carbureter with heavier fuel. To assist in the vaporization of the lower-grade fuels, more heat is necessary than for gasoline. This is due largely to the fact that the latent heat of the heavier fuels is greater than that of gasoline.

Starting Appliances.

It is reasonable to conclude that a mechanical starting device will always be required for low-grade fuel motors, and that in addition either the use of a high-grade fuel for the first few moments of operation will be necessary, or else a method of priming. In many respects the latter method is preferable, especially if acetylene be used, since it permits starting without special carbureter adjustment (other than choking of the air), simplifies bi-fuel tank and piping complication, and further introduces into the primary charges a high-velocity combustible which serves as kindling material for what is practically a normal charge.

There is every reason to believe that in the natural course of events engine-starting appliances will soon become a practical necessity on all motor vehicles, so that the development of such devices for commercial vehicles in connection with the adoption of low-grade fuels need not be viewed in the light of a special and purely incidental burden. Practically speaking, starters are more necessary on commercial vehicles than on pleasure cars, through their economic advantage in conserving the driver's energy, and because they permit the shutting down of the engine for all loading stops.

Commercial Car Feature.

As a large proportion of commercial vehicle types may be said more truly to be in the early stages of evolution than are pleasure vehicles, it follows that the adaptation of special apparatus for handling low-grade fuels will work less hardship on the truck manufacturer than it would if forced on the builder of established types of pleasure vehicle. Further, the higher valuation placed on operating economy by the commercial vehicle purchaser must tend to render the kerosene or naphtha-burning machine a more acceptable offering in that field than a pleasure car possessing the same feature would be in its field. Indeed, were it possible to offer almost any large truck user a carbureter that would handle a low-grade fuel as efficiently as his present carbureter handles gasoline, there is little question that he would accept the substitute immediately, on the basis of a not unreasonable performance guarantee.—From a paper read recently before the Society of Automobile Engineers in New York by Mr. N. B. Pope.

READER, WHAT DO YOU KNOW?

Among readers of The Power House there is a clearly defined sincerity of desire to know how each overcomes the daily problems arising out of the care and operation of the power plant. It is believed that your methods of solving these are valuable, and can be made more so, if you publish them, so that other brains may help in the work. We will provide the setting and pay you for the material. When your fellow engineer puts the super-structure on your foundation, we pay him and pass the "kink" on to you, free. Get into the game.

CAN. GEN. ELECTRIC ABSORBS ALLIS-CHALMERS-BULLOCK.

MR. Frederic Nicholls, President of the Canadian General Electric Co., authorizes the statement that negotiations have been concluded with the Allis-Chalmers Co., of Milwaukee, and the Allis-Chalmers-Bullock Co., of Montreal, resulting in the acquirement by the Canadian General Electric Co. of all the properties and assets of the Allis-Chalmers-Bullock Co. in Canada, as well as an agreement with the Milwaukee Co., which gives the Can. Gen. Electric Co. the exclusive right to manufacture and sell in Canada the types of apparatus for which the Allis-Chalmers Co. have achieved a reputation, such as Corliss engines, water wheels, sawmill machinery, flour mill machinery, mining machinery, cement machinery, gas engines, etc.

The business will be conducted under the name of the "Canadian Allis-Chalmers, Limited," a charter having been applied for, and Mr. Milne, Manager of the Allis-Chalmers-Bullock Co., will continue as manager of the new concern. The Canadian General Electric Co., with its subsidiary companies, the Canada Foundry Co. and the Canadian Allis-Chalmers, are now in a position to build and equip completely any industrial enterprise, as they manufacture the structural steel required for the buildings; Corliss engines, steam turbines or water wheels for the motive power; boilers, pumps, electric cranes and everything else required for the equipment, and sawmill machinery, flour mill machinery, mining or cement machinery for operation.

Storage of Chemicals. — In a paper read before the recent eighth International Congress of Applied Chemistry, attention was drawn by Dr. Julius Aeby to the numerous dangers which are likely to arise during the storage of various heavy chemicals owing to reasonable precautions not being taken to guard against their occurrence. Bleaching powder will occasionally decompose under elevation of temperature, though it is claimed by the manufacturers that this only occurs when the material is new; potassium permanganate if accidentally mixed with sawdust or fine sweepings will ignite by friction; arsenic acid may retain enough nitric acid to burst its drums during excessive heat, say, in the summer time; metallic sodium must be kept away from air and water; and cyanamide should be kept from water and naked lights, on account ofthe occasional presence of calcium carbide in it. An ample instance of the latter danger was furnished recently by the loss of a Norwegian vessel which was carrying a cargo of cyanamide.

A Brief Statistical Review of Steam Boiler Explosions

By R. N. Blackburn, Wh. Sch.*

The writer of this paper makes no attempt to deal with details of steam boiler design or construction, his purpose being rather to review briefly such statistics of boiler explosions as are available, with the idea of giving the data more publicity, and securing for it more consideration than appearances would indicate it to be at present receiving.

NO official statistics are available of the number of boiler explosions in Canada, and I have not been able to obtain sufficient information to justify me in making even a rough estimate of them. Excepting in the Western Provinces of Canada where provincial inspection laws are in force, the importance of the proper supervision of steam boilers does not appear to be sufficiently realized. No records appear to be kept of the number of boiler accidents in Eastern Canada, and we can only form an idea of their probable number by a comparison with the U.S., over the greater portion of which similar conditions exist. In the United States, with the exception of the States of Massachusetts, Minnesota, Ohio, Pensylvania, Tenessee and Montana, together with a few of the larger cities, there is no compulsory inspection of steam boilers. There are, however, a number of Boiler Insurance Companies who collectively supervise and inspect a very large number of boilers, and whose operations must have a beneficial effect in reducing the number of boiler explosions.

One of these, the Hartford Insurance Company, has for a number of years kept a record of such boiler accidents as have come to their knowledge. This company, with agents in most of the States of the Union, is no doubt very favorably situated for obtaining information, but it may reasonably be supposed that many comparatively slight accidents must occur which do not come to their knowledge and which, if recorded, would considerably increase the total number. In instituting a comparison between the number of boiler explosions in different countries, diverse legal definitions of what is involved in the word "boiler," present more or less difficulty.

Comparison Between Different Countries

The definition of the term "Boiler" in the Boiler Explosion Acts of 1882 and 1890 of the United Kingdom is a very wide one, and covers not only all classes of steam boilers, but also embraces heating systems, steaming kettles, drying cylinders, boiling pans, kiers, steam ovens and piping. No definition is given in the Act of the term "explosion," but the interpretation given in practice is very wide and is held to include such minor accidents as the blowing out of a manhole jointing ring, the fracture of a valve cover and the blowing out of a rivet, and it has even been held to cover the bursting of a coffee urn in a restaurant. The latest report issued by the British Board of Trade gives the total number of boiler explosions in the United Kingdom for the twelve months ending June 30, 1911, as one hundred.

An analysis of the report shows that 65 of the above were explosions of steam ovens, heating pans, digesters, steam valves, traps and piping, which cannot be classed as steam boilers in the usual meaning of the term, and of the remaining thirty-five explosions, at least four of them are so trivial that they cannot properly be classed as explosions.

In comparing the number of boiler accidents in different countries it is evidently necessary to place the statistics on a uniform basis, and in preparing the following tables, this has been done as far as possible by restricting the meaning of the term "boiler explosions" to the commonly accepted meaning. On this basis, the number of boiler explosions for the last ten years for which particulars are to hand are as follows:

United Kingdom.

Years.	Explosions	Persons Killed
1901-2	17	8
1902-3	16	14
1903-4	23	10
1904-5	17	5
1905-6	17	14
1906-7	16	8
1907-8	18	13
1908-9	35	12
1909-10	24	9
1910-11	31	3
Total	214	96
Average per annum	21.4	9.6

France.

Accidents per 10,000 pieces of apparatus.

Years	Explosions	Persons killed	Persons injured
1890-94	3.0	1.8	1.6
1895-99	3.2	1.9	2.0
1900-04	2.3	1.5	2.2
1905-09	1.8	1.2	1.4

Boiler accidents for the years 1908 and 1909—the only years for which I have the actual numbers, are:—

Years	Explosions	Persons killed	Persons injured
1908	28	13	41
1909	29	15	26
Average per annum	28.5	14	33.5

Germany.

Year	Explosions	Persons killed	Persons injured	Total killed and injured
1898	18	3	28	31
1899	14	13	22	35
1900	13	6	18	24
1901	17	10	17	27
1902	17	7	17	24
1903	10	6	5	11
1904	15	5	13	18
1905	9	4	5	9
1906	15	5	3	8
1907	16	7	9	16
Total ..	144	66	137	203
Average per annum	14.4	6.6	13.7	20.3

United States.

Years	Explosions	Persons killed	Persons injured	Total killed and injured
1901	423	312	646	958
1902	391	304	529	833
1903	383	293	522	815
1904	391	220	394	614
1905	450	383	585	968
1906	431	235	467	702
1907	471	300	420	720
1908	470	281	531	812
1909	550	227	422	849
1910	533	280	506	786
Total	4493	2835	5022	7857
Average per annum	449.3	283.5	502.2	785.7

Annual Average During 10 Years.

Country	Explosions	Persons killed	Persons injured	Total killed and injured
U. Kingdom	21.4	9.6	13.7	20.3
Germany	14.4	6.6	13.7	20.3
France**	28.5	14.0	33.5	47.5
U. States	449.3	283.5	502.2	785.7

**Average two years only.

Number of Steam Boilers.

The figures for the United States are to say the least, somewhat startling, and

*Chief Inspector of Steam Boilers, Province of Saskatchewan.

although there are probably more boilers in operation in the United States than in any of the other countries mentioned, the difference in the number of boilers is not sufficient to account for the increased number of boiler accidents.* The number of boilers in the United States was estimated in 1900 at from 150,000 to 200,000, these figures being taken from evidence given before the Select Committee of the House of Commons in that year. The number of steam boilers in France is probably about 150,000.

No records are available of the number of steam boilers in the United States, but it may reasonably be assumed that the number of boilers in each of the above countries is approximately proportionate to its population. The respective populations in round numbers are as follows:—

United Kingdom 42	millions
France 39	"
Germany 60	"
United States 76	"

Remembering that the United Kingdom is essentially a manufacturing country, it may confidently be assumed that the number of steam boilers in the United States is less than twice as great as the number of steam boilers in the United Kingdom, and when we consider that the number of boiler explosions in the United States is over twenty times as great as in the United Kingdom, and nearly seven times as great as in the United Kingdom, France and Germany combined, it is evident that no reasonable difference in the estimate of the number of boilers in the respective countries is adequate to account for the difference in the number of boiler accidents. A comparison of the number of persons annually killed is even more unfavorable to the United States, the number of persons annually killed by boiler explosions being nearly thirty times as great as in the United Kingdom and over nine times as great as in the United Kingdom, France and Germany combined.

There are no records of the number of boiler explosions in Canada but it is to be feared that, excepting in the Western Provinces where steam boilers are regularly and systematically inspected, the percentage of steam boiler explosions is nearer the standard of the United States than that of Europe.

Types of Boiler Not Accountable.

I do not think that the great difference in the number of boiler explosions in the United States and Europe can be accounted for by the difference in the standard types of boilers used. Experience shows that no type of boiler is free from accident, and although some types of boiler are, no doubt, more liable to explosion than others, the difference in this respect is not so great as is sometimes supposed. It was at one time claimed that the water tube boiler had solved the problem of making a practically non-explosive boiler, but experience shows that the percentage of accidents to water tube boilers is not materially less than in the case of other boilers of good design and construction. The explosion of water tube boilers at Milwaukee in 1909 and St. Louis in 1903, show also that the explosion of a water tube boiler can also be as disastrous as that of the ordinary fire tube type of boiler. In the latter case, the whole range of seven water tube boilers

R. N. BLACKBURN, Wh., Sch.

exploded, killing 8 and injuring 21 persons, and in the former case, 4 water tube boilers exploded, killing 1 person and injuring one person, besides causing damage estimated by the owners at $114,000.

Supervision and Inspection Feature.

The relatively enormous number of explosions in the United States is rather to be attributed to the lack of proper supervision and inspection. This is clearly shown by the records of such States and cities as have laws enforcing efficient inspection of steam boilers. In the State of Massachusetts, it is claimed that the number of boiler explosions is less than .002 per cent. of the number of boilers in operation. In Montana, where State inspection laws are in force, no boiler explosion occurred last year.

It is difficult to imagine what the number of Boiler Explosions in the United States might be, but for the operations of Boiler Insurance Companies and the municipal inspection of many of the larger cities, the ignorance and recklessness of some steam users being almost incredible. Many instances might be given, but two will suffice.

Ignorance and "Recklessness."

Until a short time ago, a boiler was located under a sidewalk in Woodward Avenue, in the fashionable shopping district of Detroit. Compulsory inspection laws made it possible to seek out this boiler for examination, and the first tap of the inspectors hammer punctured the plate like cardboard. Thousands of people had passed daily over this subterranean mine for years without knowing anything of their danger.

A Lancashire boiler was found to have a fracture at the root of the angle iron securing the front head to the boiler shell. Repeated caulking proving ineffectual to stop the leakage, a wood strut was wedged between the boiler head and the brick wall of the boiler house. As the fracture gradually extended circumferentially around the boiler, the resourceful owner added more props until finally the boiler exploded carrying all before it, including the owner, a victim of his misplaced ingenuity.

The Attendant Not Always to Blame

It was at one time the practice to attribute nearly all boiler explosions to the ignorance or carelessness of the engineer in charge, the immediate cause of the explosion being usually attributed to low water. This practice still survives, and as the engineer is frequently killed and unable to exonerate himself, the verdict generally goes unchallenged. A letter from a Canadian manufacturer was shown to me quite recently, in which it was contended that at least ninety-nine per cent. of boiler explosions were caused either by low water or by the engineer not keeping his boiler clean, his argument being that regulations governing the design and construction were unnecessary.

The result, however, of a number of careful enquiries shows that many explosions cannot be attributed to these causes, and various fanciful and elaborate theories have been advanced to account for boiler explosions which could not be accounted for on the "low water" or "scale" hypotheses. Some of these theories may be briefly mentioned:—

Electricity Theory.

Electricity is supposed to be generated by friction of the water on the boiler plates, or by the rush of steam through the main steam outlet, but it does not seem very apparent, however, why electricity, even at a high potential, should cause the boiler to explode.

Spheroidal Conditions of the Water.

If a drop of water is thrown on to a very hot plate, it immediately assumes

*The number of boiler accidents per annum in the United States is estimated by the Superintendent of the Fidelity and Casualty Co. of New York at between 1,300 and 1,400, of which 300 to 400 are violent explosions.

the spheroidal condition, and the globules are prevented from coming into actual contract with the hot plate by a cushion of steam which surrounds them. As the plate cools, the water loses its spheroidal form and the globules spread out and are immediately evaporated into steam. In the case of a boiler, it was supposed that under certain circumstances the water assumed a spheroidal condition and under a slight reduction of temperature caused for example by damping the fire, the water would leave its spheroidal state and coming into contact with the heated plates would generate steam in such large quantities that the safety valve could not carry it off; as a consequence, the boiler would explode from over pressure. This theory is undoubtedly very ingenious, but the matter-of-fact boiler inspector of the present day would merely argue that the safety valve was too small for the boiler.

The Oxy-Hydrogen Gas Theory.

It was supposed that at the high temperatures of the furnace, water was decomposed into its constituent gases, oxygen and hydrogen, which afterwards re-united to form steam. This re-union is accompanied as every student of chemistry knows, by a violent explosion. The theory has not been proved, however, and though numerous attempts have been made to reproduce the supposed conditions experimentally, they have not been attended with success.

The Hydrogen Gas Theory.

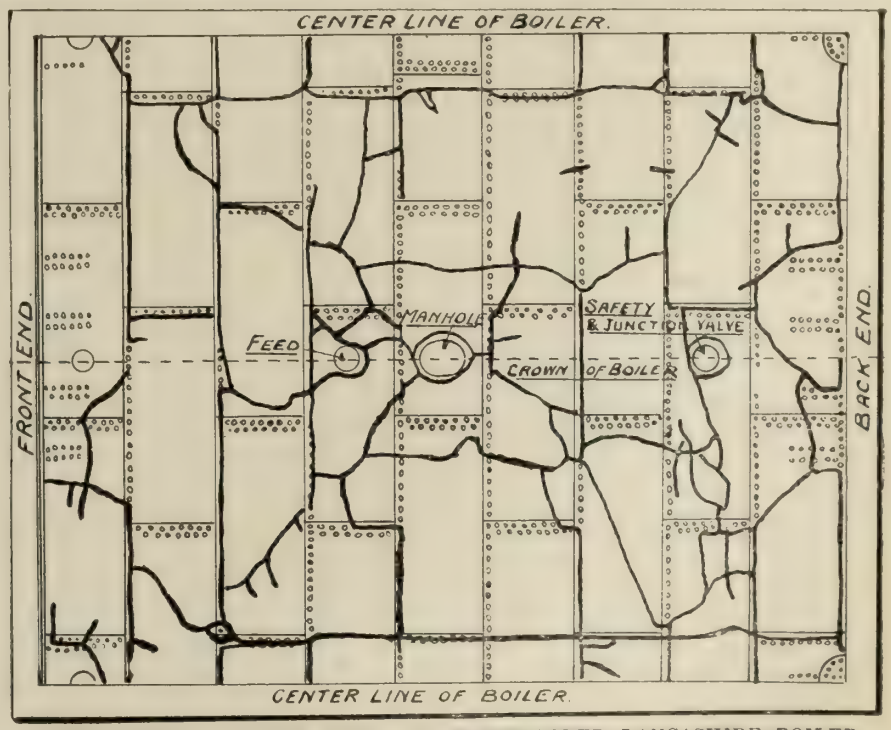
It is well known that steam coming in contact with red hot iron is decomposed, the oxygen uniting with the iron to form magnetic oxide of iron and the hydrogen being set free. The amount of hydrogen which might be thus liberated in a steam boiler is, however, very little, and as it could not explode except in the presence of free oxygen, it is not probable that any boiler has ever exploded from this cause.

Water Purged of Air.

When the air has been driven out of water and the latter is quiescent, it has been shown that the water may be heated considerably above the normal boiling point before being evaporated into steam. It is said that water has been heated in this manner as much as fifty degrees Farenheit above the boiling point before boiling actually commences. When boiling once commences, the excess heat immediately converts a considerable portion of the water into steam and an explosion follows. While a boiler explosion from this cause is perhaps not impossible, it does not appear likely to occur except under very exceptional conditions, and most boiler explosions can be readily accounted for without invoking the aid of either this or any of the above theories. No doubt the extreme violence of some boiler explosions led engineers to seek some explanation along the lines of a fulmination which alone appeared sufficiently violent to account for the devastation which sometimes occurs when a boiler explodes.

Lancashire Boiler Explosion.

The accompanying diagram represents the development of the shell of a Lancashire boiler which exploded at Dislington, England, on the 18th day of September, 1909. The force of the explosion ruptured the boiler into a large number of pieces. Fifty of the larger of these were recovered and pieced together. The lines of rupture are indicated in the diagram by heavy lines. The



DEVELOPMENT OF THE SHELL OF AN EXPLODED LANCASHIRE BOILER, SHOWING THE LINES OF RUPTURE.

effect particularly when the ductility and tenacity of boiler plate is considered, appears rather as if the boiler had been ruptured by the detonation of some explosive than a mere giving way under a static pressure.

Cause of the Widespread Rupture.

What actually occurs when a boiler explodes in this manner appears to be as follows:

The boiling point of water varies with the pressure, and while water at atmospheric pressure boils at 212 degrees Faht., at a pressure of say 150 lbs. per square inch, the boiling point is raised to about 366 degrees Farenheit. When a boiler ruptures under steam pressure, the temperature of the water, if the rupture is large, falls almost instantaneously to a temperature of 212 degrees and the excess heat causes the immediate generation of an immense number of minute bubbles of steam throughout the whole body of water in the boiler. This causes an extremely rapid and violent expansion of the water which is projected with enormous velocity over the whole interior of the boiler. The momentum of a large mass of water in such rapid motion is almost irresistible and the boiler is shattered and the pieces hurled in all directions. The energy thus developed is very great.

Stored-Up Energy.

Professor Thurston states that a cubic foot of heated water under a pressure of 60 or 70 pounds per square inch has about the same energy as a pound of gunpowder.

The energy in foot pounds stored up in one pound weight of heated water at a temperature of T degrees Farenheit is expressed by the formulae:

$$W = 778\ T - (212 + 673 \text{ Hyp. log} \frac{T+461}{673})$$

The weight of a 72-inch x 18 ft. horizontal return tubular boiler is about 20,000 pounds. The weight of water contained at the normal working level is about 17,000 pounds, and the weight of steam at 150 pounds gauge pressure is about 45 pounds. The energy stored up in the heated water is therefore 198,390,000 foot pounds and in the steam, 1,635,637 foot pounds. The total energy liberated when the boiler exploded is, therefore, over 200,000,000 foot pounds, sufficient to raise it to a height of about 10,000 feet, or nearly two miles.

Fortunately the energy stored up in a ruptured boiler is usually dissipated more gradually, and it is but seldom that the conditions are such as to release this large amount of stored energy instantaneously, yet the effects of a boiler explosion are sufficiently serious, and when a boiler in fairly good condition bursts from over pressure, the consequences are usually disastrous.

Causes of Boiler Explosions.

The immediate causes of 1079 boiler explosions have been tabulated by Mr. B H. Thwaite and were given by him in a lecture before the Yorkshire College Textile Society, as follows:

External corrosion	152
Overheating	133
Over-pressure	118
Weakness of Flue	106
Fracture	80
Internal corrosion	72
General deterioration	58
Defective stays	54
Malconstruction	51
Grooving	31
Deposit	27
Weak manhole	23
Bad material	11
Absence of safety valve	7
Cause not ascertained	156
	1,079

It may be pointed out that explosions under at least seven of the above headings may, in most cases, be ascribed to faulty design and construction, and some of the explosions under the other headings are sometimes traceable to the same cause. For example, boilers are frequently constructed, which, owing to insufficient mudports, are almost impossible to keep clear of deposit, or to ascertain the condition of the boiler internally. Faults in design are constantly being brought to my notice, and the importance of proper supervision of the design and construction of steam boilers can scarcely be over-estimated.

It should also be noted that the majority of purchasers of steam boilers have little or no knowledge of the principles underlying their design and construction and are not able to judge for themselves as to the respective merits of different boilers offered. Manufacturers, again, who, for their own reputation, would prefer to furnish boilers of a high standard, may have to meet the competition of others who offer boilers at a lower cost, made of poor materials, together with bad workmanship, and oftentimes defective design.

Overloading Steam Boilers.

It appears to be an almost invariable rule that the load on steam plants shall be gradually increased until the capacity of the boilers is taxed to the limit. In a factory, as the business extends, new machines are added; in a municipal plant, as population increases, the load is increased until the plant is over-loaded and something must be done to increase the power of the engine. Obviously, the easiest and quickest method is to raise the boiler pressure, and where the boiler pressure is not limited by inspection laws this method of increasing the power is usually adopted. The boiler has probably been running for years at the pressure for which it was originally constructed, and the increase comes at a time when, in the ordinary course of events, the pressure should rather be reduced on account of depreciation, due to wear and tear.

Where the maximum pressure allowed to be carried is limited by inspection laws, the speed of the engine may be increased or an additional engine installed and supplied by the same boiler or battery of boilers, the latter being forced to supply the required steam. This leads to overheating and greatly increased wear and tear, and the plant being short of boiler power, a boiler cannot be laid off for cleaning without a partial stoppage of the factory. Scale is allowed to accumulate, and the stresses set up by the consequent overheating of the plates or by the undue forcing, develop faults in the structure and too frequently ends in adding another accident to the already long list of boiler explosions.

Boiler Inspection in Saskatchewan.

The first Act providing for the compulsory inspection of steam boilers in the Province of Saskatchewan was passed in 1898. New Acts were passed in 1901 and 1906, and the Act of 1906, with amendments made in 1908 and 1909 is still in force. The Acts have operated very successfully and the almost complete immunity of the Province from boiler explosions testifies to their efficiency. As many boilers in the Province were, however, found to be of faulty design and construction, it was soon realized that an adequate system of inspection should commence with the supervision of design and construction, alike in the interests of public safety and also for the protection of the purchaser.

Provincial Conference.

After some correspondence with neighboring provinces, a conference was held at Regina in December, 1909, which was attended by representatives of the Governments of British Columbia, Alberta, Saskatchewan, Manitoba and Ontario, and by a representative of the Canadian Manufacturers' Association. At this conference, regulations were drawn up governing the construction of steam boilers and providing for the examination and registration of designs which have since been adopted by the Government of Alberta and Saskatchewan. Regulations of a similar kind have been in force in British Columbia since 1902. The Provinces of Manitoba and Ontario have not yet adopted regulations, but I have been given to understand that the Province of Ontario will probably adopt them in the near future and the Province of Manitoba will soon follow.

Saskatchewan Province Regulations.

The superiority of boilers built to the Saskatchewan regulations is becoming recognized outside our own province and I understand that there is a considerable demand in the United States for boilers built to Western Canada regulations. This is particularly the case with agricultural machinery and I have been informed by the representative of one of the largest makers of this class of product in the United States, that they are now building all their boilers to comply with the Western Canada regulations.

The regulations have been in force in Saskatchewan since January, 1911, and in Alberta since January, 1910, and have produced a marked improvement in the design and workmanship of boilers coming into the province.

Before commencing work on any boiler, the manufacturer is required to submit to the Department of Public Works, blue prints and specifications for approval. When the design is approved, it is registered, and the manufacturer is notified as to the working pressure the boiler will be allowed to carry. He is thus in a position to guarantee to the purchaser that the boiler has been approved for a given working pressure. After registration of the design, the manufacturer may build any number of boilers to that design without further registration of drawings. Further, the manufacturer is required to furnish the purchaser with an affidavit that the boiler has been built in accordance with the design and specification which has been registered and approved by the Department of Public Works. The affidavit, also certifies that all material used in the construction of the boiler is of the standard required by the regulations, that the workmanship is in accordance with the Department's requirements, and that the boiler has been properly tested before being sent out of the manufacturer's workshop. This method of proceedure considerably simplifies matters for the manufacturer. Full particulars of approved designs, giving the dimensions and ratings of the various parts of the boiler are given to each inspector so that an efficient check is maintained by the Department on each boiler shipped into the province.

Up to the present time 314 designs of steam boilers and 238 designs of steam fittings have been approved and registered by the Dept. of Public Works.

Handling Heavy Machines and Their Parts Under the Crane*

By John Riddell**

The importance of the subject here dealt with, is, we believe, fully realized by those responsible for the management and operation of machine and erecting shops, foundries, etc.; at the same time, all of us need to be reminded, if not re-informed, concerning our work and the manner of its production, and to those who are responsible for the lifting and transportation of machine parts from department to department of our factories, this descriptive article will be found of the highest value.

THE handling of heavy machines and parts of machines in a large electrical factory is a matter of the greatest importance. The apparatus used includes traveling cranes, jib cranes and other machinery; and, during the ordinary working day, has to deal with weights varying between very wide

30 DEGREE ANGLE SLING, WRONG WAY.

limits. The different cranes may vary in capacity from, say, 3 tons to 100 tons, and the weights of the pieces which have to be handled may be anything from 100 lbs. to 100 tons.

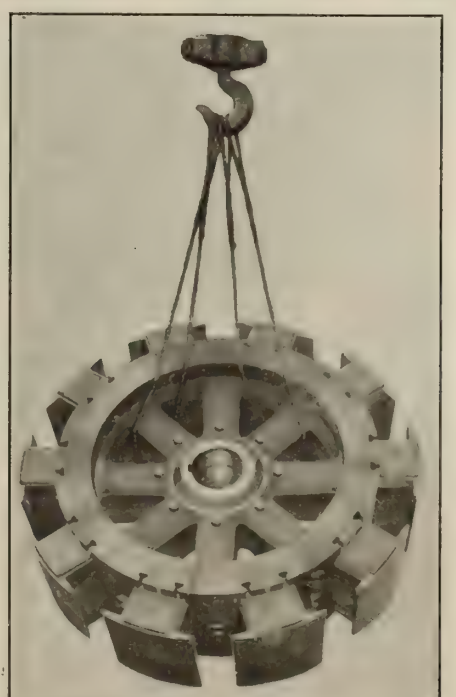
As a general rule, no particular trouble need be expected in handling the larger weights, since, owing to their importance, more care is exercised in making hitches and other preparations, and usually the foreman, or some other leading man, sees that all accident is guarded against. It is from pieces of medium and light weight, of which a great many are handled every day, that trouble more often results. The man handling so much of this class of work becomes thoughtless, the slings become chafed and worn, while the chains become crystallized by long use. The last is a frequent cause of trouble.

Ropes and Slings.

There is a great difference between ropes and slings used for hoisting. In ropes, the wear can always be seen by the strands becoming frayed, loose or cut. A chain, on the other hand, outside of a few bruises, will not show any signs of weakness; although actually it may be full of small cracks, which cannot be detected by the naked eye, or it may be much crystallized by long use. A chain under these conditions rapidly becomes weaker with each lift, until it finally gives way, letting something fall on the man who used it, or, as is more frequently the case, on some innocent shopmate.

Care of Chains and Slings.

Whether anyone is hurt or not, there is always a loss to the factory. Sometimes it may only be a rough casting, but very often it is a piece of finished apparatus on which much time and labor have been spent; and, worst of all, there is usually urgent need for the apparatus at its destination, involving disappointment. Suitable racks should be provided for hanging chains and slings, and, when not in actual use, they should be kept there. When not employed attending to lifts, the followers should be inspecting these slings, in order to detect weakness and sort out those which are bad, so that they may be repaired. These racks also afford a ready means for the head rigger's inspection, who is in charge of all such apparatus, and who should always be consulted when anything of a doubtful character in relation to hoisting comes up.



PROPER METHOD OF MAKING HITCH FOR TURNING REVOLVING FIELD, STRAIN BEING EQUALIZED.

There are many varieties of hitches and many kinds of knots. Some are useful, others are ornamental; only the

PROPER METHOD OF MAKING HITCH. THE FRICTION OF CABLE AROUND THE OBJECT GIVES APPROXIMATELY A TWO PART CABLE.

useful kind will be considered here. Some knots and hitches are shown for use in special cases only, not being intended for everyday service in machine shops. They are useful, however, for riggers, millwrights and others handling special machinery and materials, and should be used only by men competent in such work.

Wire Cable Slings.

Wire cable slings occupy a very important place in hoisting, and have been found very satisfactory when carefully used. A wire cable sling should never be used singly when hooked by a spliced eye. When the weight is sufficient the cable is likely to untwist, thus allowing the splices to open and slip. Such slings should always be used double, and where sharp corner or rough castings exist, the cable should be protected by pads, as shown in Fig. 2. Another method of protecting the cable is by two loose metal blocks that should be perfectly free to adjust themselves and afford ample protection for the slings so used.

In using slings of any kind, especially

*Abstracted from the "General Electric Review."

**Mechanical Superintendent, Schenectady Works, General Electric Co.

rope, care should be taken to see that they are properly laid; that is to see that one rope does not lie on top of the other, as this will prevent proper equalization, putting an undue strain on the outer rope. It very often happens, when a rope sling is used double, that the ends of the rope are passed through the

Sudden Stoppage of Load.

Before lifting heavy loads by means of a crane, the crane brakes should always be tested to see that they are in good condition, and that they will hold. Care must be used when lowering loads to limit the speed, which should not exceed the hoisting speed of the crane for the load at such speeds within a distance of ⅛ in. may double the stress on the slings and crane.

This point cannot be emphasized too strongly; as, in more than one instance, serious accidents have resulted from the sudden stopping of cranes while the load was being lowered.

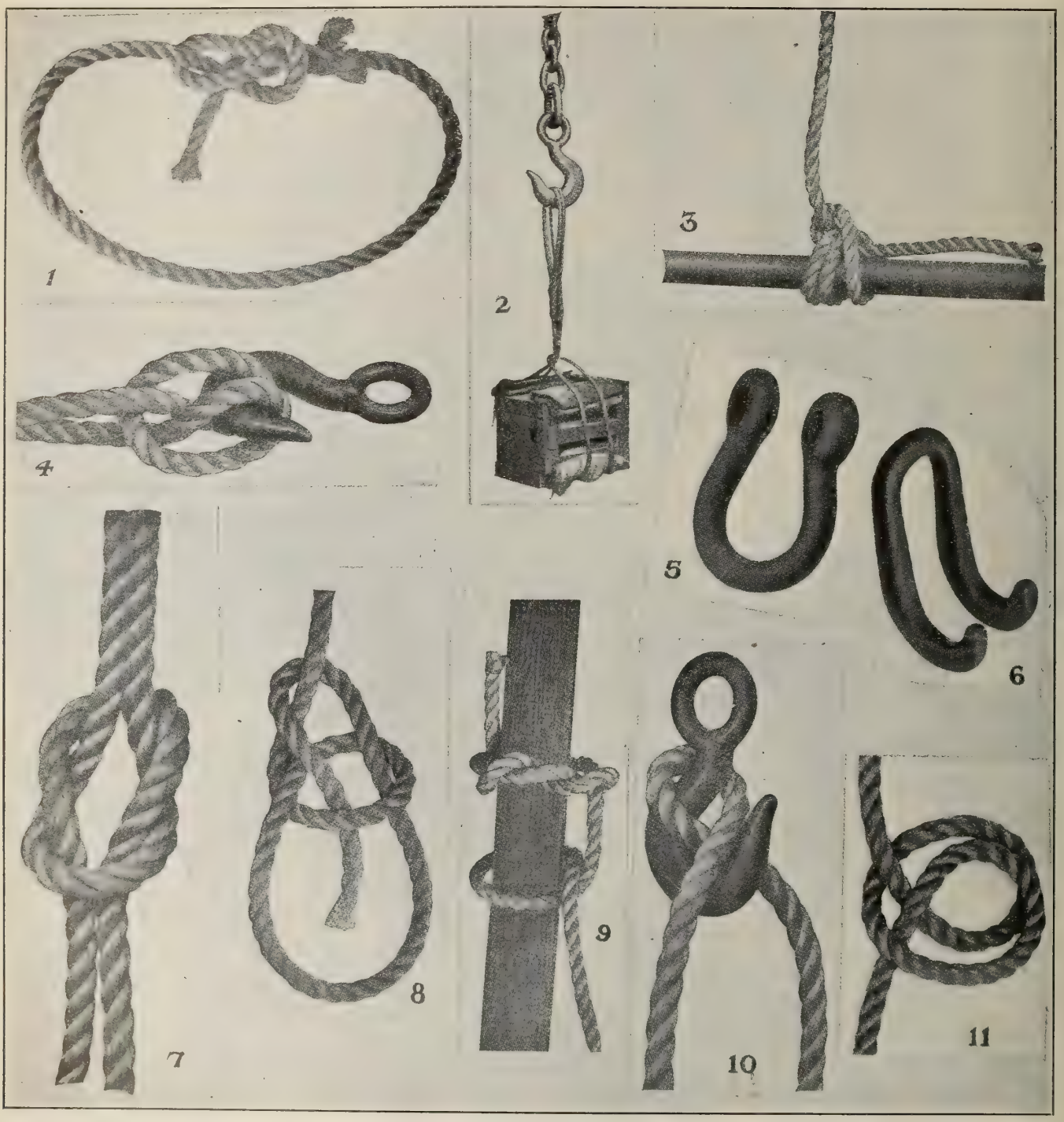


FIG. 1. SHEET BEND IN EYE. FIG. 2. DOUBLE CABLE SLING, RIGHT WAY TO LIFT LOAD. FIG. 3. STUDDING SAIL HITCH. FIG. 4. CLOVE OR DOUBLE HALF HITCH. FIG. 5. SHACKLE. FIG. 6. DOUBLE HOOK. FIG. 7. SQUARE OR REEF KNOT. FIG. 8. BOWLINE COMPLETE. FIG. 9. TIMBER HITCH AND HALF HITCH. FIG. 10. BLACKWALL HITCH. FIG. 11. CLOVE OR DOUBLE HALF HITCH.

doubled part, as when placed around a casting; and, unless this is done carefully, instead of having the strength of two parts of a rope, as supposed, it can be so slipped around the casting, or other piece being lifted, as to actually only have the strength of one part.

the same load, and particular care must be taken to apply the brakes gradually when bringing the load to rest. The ordinary hoisting speed for a 30-ton motor-operated crane is about 18 ft. per min., and for a 50-ton crane about 12 ft. per min. with the rated load. Stopping

When a weight is lifted by two or more slings connected to the crane hook and making an angle with each other, the increase in the stress of the individual slings must be considered. On account of this angle between the two sets of slings, the stress on each set is

greater than half the total load, and increases very rapidly as the angle between the sling and the work is decreased. An angle of 45 deg. between the sling and the work makes the stress in each sling three-fourths of the total weight, and the collapsing force between the two points of attachment to the work is equal to half the weight. This collapsing force acts in a direct line between the two points of attachment. If the work is ring-shaped, it would tend to deform the ring.

A spreader of sufficient stiffness should be used between these two points to resist this collapsing force. It will be seen that eye-bolts are not suitable for attaching the slings to the work unless a spreader is used to relieve them of this side pull, which would put a heavy bending moment on the shank of the bolt. Reducing the angle between the sling and the work to 30 deg. makes the stress in each sling equal to the total weight, and the collapsing force is also equal to the total weight. Such a small angle should never be used if avoidable.

Safe Loads for Eye-Bolts.

When it is necessary to use eye-bolts for lifting loads, no greater strain should be allowed than given in Table 1, which gives the safe load in pounds for bolts up to and including 2¼ in. diameter. It should be noted that the values given are correct only when the pull is in the lengthways direction, and when the bolt is in good condition.

It should further be understood that,

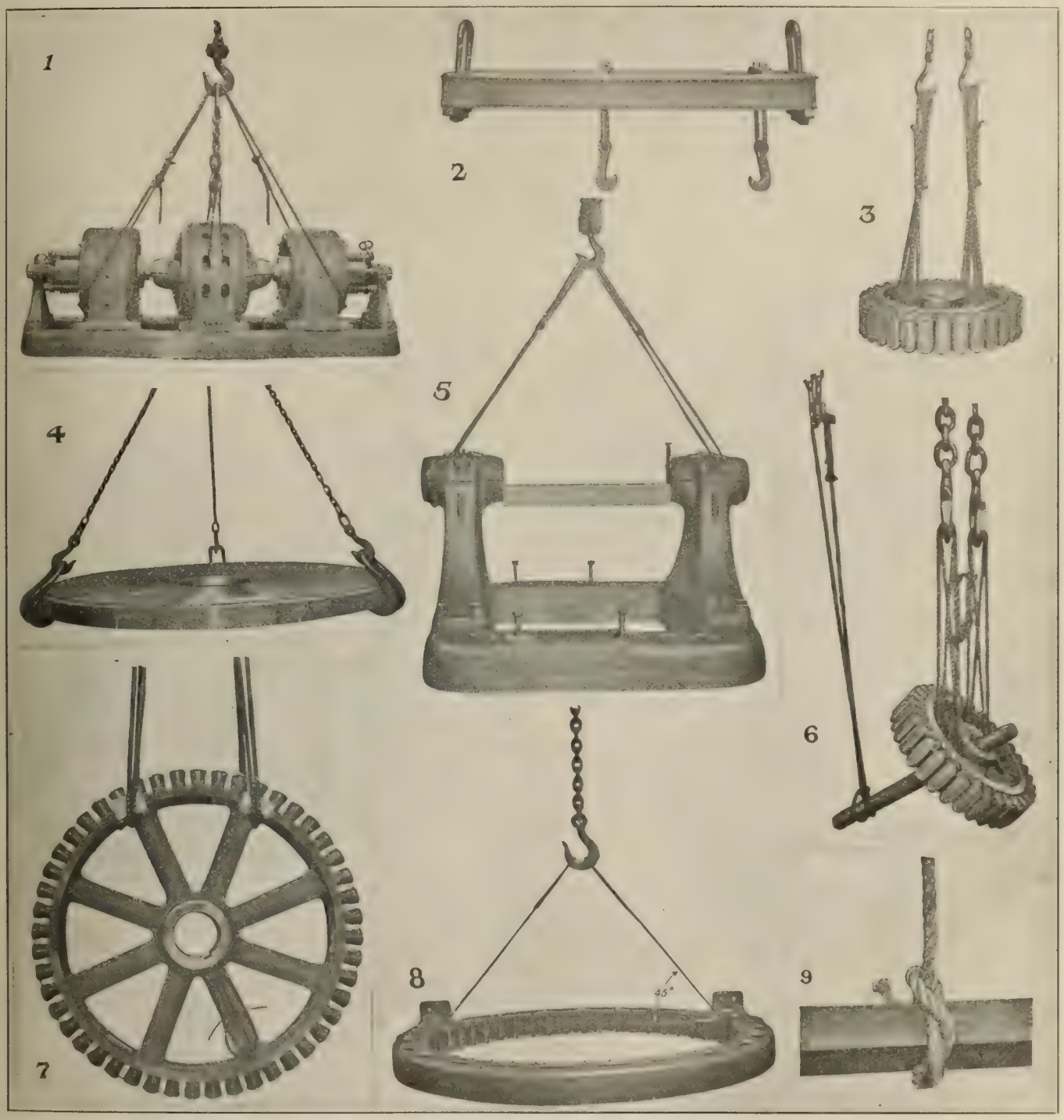


FIG. 1. PROPER WAY OF LIFTING THREE UNIT SET. FIG. 2. EQUALIZER USED WITH TWO CRANES. FIG. 3. METHOD OF LIFTING AND TURNING REVOLVING FIELDS, FIRST POSITION. FIG. 4. RIGHT WAY OF LIFTING PLATE WITH THREE HOOKS. FIG. 5. METHOD OF LIFTING BASE AND STANDARDS. FIG. 6. METHOD OF LIFTING AND TURNING REVOLVING FIELDS, SECOND POSITION. FIG. 7. RIGHT WAY TO LIFT REVOLVING FIELD. FIG. 8. 45 DEGREE ANGLE SLING, RIGHT WAY. FIG. 9. TIMBER HITCH.

to obtain the greatest strength from an eye-bolt, it must fit reasonably tight in the hole into which it is screwed, and the pull applied in a line with the axis of the screw. Eyebolts should never be used if considered the least faulty. They should never be painted when used for miscellaneous lifting, as paint is very apt to cover up flaws. They should be tested occasionally by tapping gently with a hammer, but not sufficient to bend or to otherwise injure them. If they do not impart a good ring there are one or two good reasons—they may fit loosely in the hole, or there may be a flaw in the material.

TABLE 1—EYE BOLTS.

	—INCHES— A	B	C	SAFE LOAD LB.
Drop forged steel	½	1½	7-16	1,100
	9-16	1 9-16	17-32	1,500
	⅝	1 11-16	⅝	1,800
	¾	1 13-16	¾	2 800
	⅞	1 15-16	13-16	3,900
	1	2 1-16	15-16	5,100
	1¼	2 5-16	1 3-16	8,400
	1½	2 9-16	1⅜	12,200
	1¾	3 1-16	1½	16,500
	2	3 1-16	1⅝	21,800
D.B.G. Iron	1¾	3	1¼	10,000
E.L., 28,000	1¾	4	1½	11,000
Lb. per sq.	2	5	1¾	14,000
in. Welded	2¼	6	2	16,000

Where a bolt is to be used for anything like its maximum load, it should be screwed in tight with a bar and given a gentle tap with a bar or hammer to see if it imparts a solid feeling; otherwise, it should not be used.

Safe Load on Ropes and Chains.

Table 2 gives the safe loads which may be put on manila rope, wire cables, and chains. The first column gives the diameter of the rope or chain, the second column gives the safe load which the rope or chain is to carry singly. In a sling, where the strain is carried by two ropes or chains, the loads given in the third column should be used. In a sling, where four parts of the rope or chain carry the load, the figures in the fourth column should be used. Figures are in tons of 2,000 lb. each. The loads for manila rope should be used only when the rope is in fairly good condition; when badly chafed or worn the load should be reduced.

As there are a great many different kinds of material to handle in the various parts of a factory, and in order to familiarize those engaged in the actual handling of these materials, a short

TABLE 2.
MANILA ROPE—SAFE LOAD IN TONS.

Dia. of Rope in In.	Single Rope.	Two Part.	Four Part.
½	⅛	¼	½
⅝	¼	½	¾
¾	⅜	¾	1¼
⅞	½	1	2
1	¾	1½	2
1¼	1	2	3
1½	1¼	2½	4
1¾	2	4	6
2	2½	5	8
2¼	3½	6½	11
2½	4½	8	13

table of the weights of the various materials is given in Table 3. The weights of cast-iron, steel, copper and lead are given in pounds per cubic foot. The weights of wood, concrete, stone, earth, brick, mortar and marble are also given in pounds per cubic foot.

TABLE 2.
CHAINS—SAFE LOAD IN TONS.

Dia. of Chain in In.	Single Chain	Two Part	Four Part
¼	½	⅞	1½
⅜	1	1¾	3
½	2	3½	6
⅝	3	5	9
¾	5	9	15
⅞	6	10½	18
1	8	14	24
1⅛	11	19	33
1¼	13	23	39
1½	18	32	54

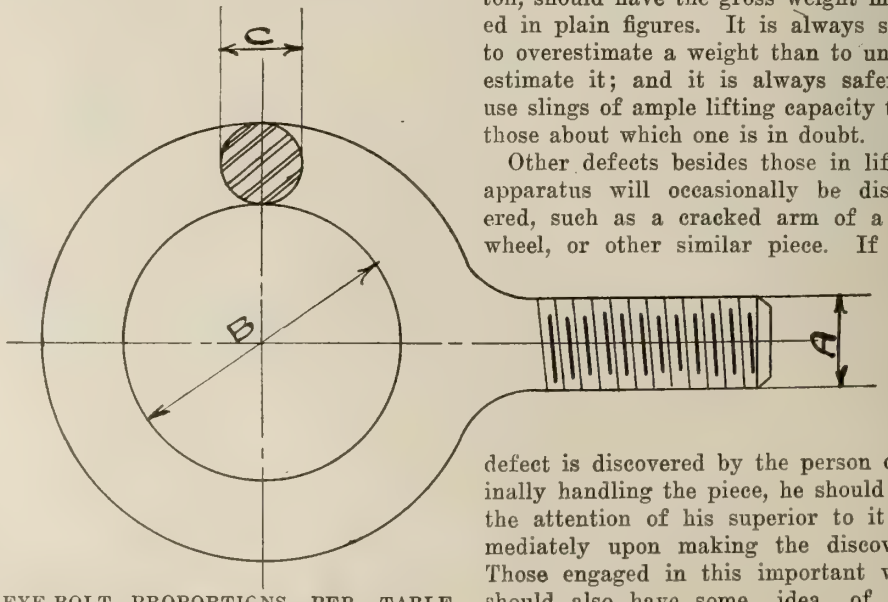
A great deal of shafting is also handled. The weight of shafts is given per lineal foot, or so many pounds per each foot in length. All that is then necessary in order to find the weight of any piece of shafting, knowing the weight per foot, is to multiply the weight by the number of feet in length, which will give the net result in pounds to be lifted. For instance, a piece of shafting 16 inches in diameter, and 1 foot long, weighs 676 lbs., and a piece of shafting of this same diameter and 16 ft. long would weigh 10,816 lbs. Provision in this case

TABLE 2.
WIRE CABLE—SAFE LOAD IN TONS.

Dia. of Cable in In.	Single	Two Part	Four Part
½	1	2	3½
⅝	1¾	3¼	6½
¾	2½	4½	9
⅞	3¼	6	12
1	4	8	16
1¼	6	12	24
1½	10	19	36
1¾	13	25	48
2	16	32	60

should be made for lifting at least six tons.

A wood or lag screw, when made in the form of an eye-bolt, should never be used on which to hang any hoisting tackle. Whenever possible, the safest way to hang such tackle is by passing the shank of an eye-bolt through a floor or beam, properly protecting the wood by a large plate washer and nut. It frequently happens that a chain or rope sling can be used by passing it over a properly secured timber. There are several good ways of doing things, and many wrong ways. Care should always be used to see that they are done in a good way.



EYE-BOLT—PROPORTIONS PER TABLE I. PULL SHOULD ALWAYS BE IN DIRECTION OF STEM AXIS.

Generalities.

Case after case might be enumerated; but enough has been said to enable any person entrusted with this work to be able to decide on a proper method, and the proper slings or other apparatus to be used. Where he is in doubt as to the weights to be lifted or methods employed, he should seek advice from those qualified to give it. For the guidance of those engaged in handling or lifting pieces, it is also suggested and urged that all irregularly shaped castings, and in fact, all castings weighing over a ton, should have the gross weight marked in plain figures. It is always safer to overestimate a weight than to underestimate it; and it is always safer to use slings of ample lifting capacity than those about which one is in doubt.

TABLE 3—WEIGHTS OF VARIOUS MATERIALS.

Material—Metals.	Weight per Cu. ft. in lbs.	Weight per Cu. in. in lbs.
Cast iron	450	0.26
Steel	489	0.28
Lead	709	0.41
Copper	552	0.32
Material—Wood.		
Ash	45	
Pine	38	
Material—Miscellaneous.		
Concrete	155	
Stone	180	
Earth	72 to 110	
Brick	100 to 150	
Mortar	100	
Marble	180	

SHAFTS.

Inches Diameter.	Weight in Lbs. per Lineal Ft.
6	95
8	169
10	264
12	368
14	517
16	676

Other defects besides those in lifting apparatus will occasionally be discovered, such as a cracked arm of a flywheel, or other similar piece. If this defect is discovered by the person originally handling the piece, he should call the attention of his superior to it immediately upon making the discovery. Those engaged in this important work should also have some idea of the strength of materials.

They should know how the strains will be set up in such materials, and also how to apply slings for lifting, as variously illustrated here. They should know that using too small an angle on the slings, as in the case of a field ring, would tend to pull the sides together; and that, in the case of a revolving field, where the sling is applied between a pair of arms instead of around adjacent arms, the tendency would be to break out a portion of the ring.

These things are all matters of judgment, and the importance of appointing proper persons to take charge of this work cannot be urged too strongly. A reduction in the number of crane accidents can only be effected by extreme vigilance. The loss of material in the past has been very great, and the suffering to humanity caused by thoughtlessness has been as great. If proper care is exercised, such accidents can be almost totally avoided.

The Care and Safe Operation of Air Compressors

The following memo has been prepared by Mr. James L. Davidson, secretary of the Alabama Coal Operators' Association, under the approval and direction of the Mine Casualty and Mining Institute Committee.

HAVING noticed in the Alabama Supreme Court Reporter a decision, awarding heavy damages to the administrators of a man killed in the mines by gas from the exhaust of a compressed air driven pump, which he went to start up; the following information gathered from reliable sources, with regard to the care and operation of air compressors, involving safety and efficiency, is likely to prove interesting and instructive.

It is a fact that air compressors frequently pollute the mine air with dangerous gases, and sometimes explode, causing damage to persons and property. In either case, the same may be generally attributed to the excessive heating, in the presence of compressed air, of the oil and foreign substances that have collected in the cylinder, discharge pipes and air passages, and especially in and around the valves. Volatilization and ignition of oil and other carbonaceous matter occur very rapidly in the presence of highly heated air. The greatest heating takes place where the air passes from the cylinder into the discharge pipe. Even although the compressor is equipped with modern and approved cooling devices, insufficiency of size or too many angles in the discharge pipe, incrustation of dust mixed with oil, at the discharge opening, decreasing the capacity of the discharge may each or all produce enough heat to cause an explosion, or produce dangerous gases, which should not enter the mine.

Two Important Points.

It is therefore important:

First—to keep the compressed air while being compressed at as low a temperature as possible.

Second—To prevent oil and other carbonaceous substances from collecting in any part of the machine or in the discharge pipes.

All ports and air passages should be as large as practicable and should be kept free from obstructions and incrustations. In addition to partly closing the ports, incrustation often causes the valves to stick, resulting in disastrous consequences. When the valves stick it causes a "Back Kick" and considerable friction in re-compression, which produces great heat.

The Oil Feature.

To avoid incrustation and collecting of oil and foreign substances in the machine and discharge pipes, high-grade non-carbonizing oil may be used and should be properly fed into the cylinder. Petroleum oil, especially free from volatile carbon, with flash point of not less than 625 degrees F. is recommended. The oil should not be too dense nor contain animal or vegetable oil. Do not in any case, use ordinary steam cylinder oil, because the heat in the steam cylinder is moist, and the surplus oil is washed out, whereas the heat in the compressor cylinder is dry, thus causing the oil to stick and cake. For the above reason, and also on account of the difference in the character of the proper lubricant and the work it has to perform, the proper feeding of oil, to the compressor cylinder, is very different from the oil feed to a steam cylinder.

Too much oil causes incrustation, and a surprisingly small quantity of good oil will give sufficient lubrication to air compressors. Watch your compressor and cut the amount of oil down to a minimum of its requirements. Oil should not be allowed to collect in the machine, and in case it does, it should not be allowed to remain, but should be drawn off immediately. Even when using the best oil, properly fed to the cylinder the machine should be cleaned frequently, or when needed.

Dont Use Kerosene.

Do not use Kerosene for cleaning! It is very dangerous. Kerosene has a flashpoint of about 120 degrees F., and the temperature of the compressed air may at any time reach 300 to 450 degrees F. and cause an explosion. The best and safest method of cleaning is to feed into the air cylinder, soapsuds, made of one part of soft soap to 15 parts clean water. Feed a liberal amount of this solution into the cylinder instead of the oil for a few hours or even for a day, if necessary. The accumulation of this water and oil should be drained off from time to time during the process by opening the blow off valve at the receiver.

To prevent rusting it is necessary to run the machine and feed oil into the cylinder for an hour or so after the cleaning process is completed and the water drained off, so that the valves and all parts connected with the cylinder will become coated with oil before shutting down the machine.

Air Temperature.

The temperature of the discharged air should never exceed 250 degrees F. The machine should be watched, and if the temperature exceeds the above, it should be shut down and cooled. If possible, the cause of overheating should be eliminated before starting up again.

The temperature increases as the pressure increases, therefore it would be well to equip all air compressors with an automatic pressure or temperature regulator, which will allow the compressor to run idle as soon as the pressure or temperature in the receiver reaches a predetermined limit, and likewise bring the compressor into action again as soon as the pressure or temperature falls below this limit. There are regulators on the market which apply to compressors coupled direct to the engine, or driven by electric motors, or driven by belt and pulleys. As an extra precaution, a fusible plug may be placed in the discharge pipe near the compressor. This plug should be constituted to fuse and blow out at a temperature of between 325 and 350 degrees F.

Remember that proper construction, proper care of the machine and high-grade lubricants, may save life, and are cheaper than shut downs, lost power, destruction of property and damage suits!

Lethbridge, Alta.—In order to induce manufacturers to locate in Lethbridge, the city is offering electric power at $12 to $16 per horse power, coal at 50 cents per ton, natural gas at 15 cents per thousand feet, free site, water and light at cost, and exemption from taxation for ten years.

THE STATUS OF ENGINEERS.

AT a meeting of the Society of Engineers (Incorporated), held on April 7th, Mr. William Ransom, A.M. Inst. C.E., read his essay on "How to Improve the Status of Engineers and Engineering, with Special Reference to Consulting Engineers," which was awarded the second prize in the Status Prize Competition last year, no first prize having been awarded.

The author pointed out that the civilization of to-day had become possible only because of the efforts of the engineer, but that the public did not sufficiently appreciate the advantages they had gained or the men whose work had secured those advantages. Engineers had many lessons to learn from the legal and medical professions, both of which excluded unqualified men and exercised a benevolent professional control over their members, and the State should recognize the engineering profession by giving it an official standing equal to that of other professions. The State should require engineering aspirants to pass a qualifying examination and should give facilities to pupils and assistants for inspecting large engineering works.

Admission to the profession required to be carefully guarded, and the number of pupils allowed to an engineer should be regulated by the extent of his practice, while the climax of the period of pupilage should be a State examination. Much more might be done to make examinations of practical value to those who prepared for them, but no other form of test was possible. When State recognition was obtained for engineers, the members of the profession would constitute one great society, amalgamating the existing societies into one body, which should have the control of professional matters and be the mouthpiece of the profession. Such a society would necessarily have sub-sections dealing with special branches of the profession. While the growth of specialization must be recognized, it was essential for those who were beginning their training for the profession to acquire a sound general scientific knowledge before they began to specialize.

The engineer should not be behind his brethren of the legal and medical professions in regard to professional conduct and etiquette, while the society that represents him should maintain a high standard of professional honor, and must have power to enforce its regulations. The State should fix a scale of minimum professional fees. Consulting engineers were comparatively few in number, and on that account the public placed a high value upon their services. They played an important part in forming public opinion on the profession and the ideals they now placed before themselves would make their impress on the younger generation of engineers.

The tone of the profession could not be set by the professional societies, but every individual must live up to a high code of professional conduct. The public estimate of the profession was based not on the conduct of the best members, but on that of the average member, hence the importance of every engineer setting an example of lofty ideals before his staff, his clients and the public.

COMPARATIVE COST OF THREE TYPES OF POWER PLANT.

AN interesting comparison of the cost of three different ways of providing an independent plant of 1,000 indicated horsepower for operating a variety of motor-driven machines, is given in a recent report by F. W. Dean, of Boston. The first plan considered was that of installing a 1,000-horsepower condensing Corliss engine, for which the costs were thus estimated:

Condensing Corliss Engine, 1,000 H.P.

Engine and Condenser,	$20,000
Foundations,	5,500
Electric Generators,	12,000
Boilers,	7,500
Smoke Flue,	750
Chimney,	2,500
Heater,	1,000
Pumps,	500
Buildings,	20,000
Total Cost	$69,750
Cost per I.H.P.	$69.75
Fixed charges, 13 per cent of $69.75	$9.07
Attendance	3.21
Oil, waste and supplies	.20
	$12.48

For coal used, including banking, the following estimate was made; assuming 310 days of 9 hours each, and 1.75 lbs. of coal per h.p.

$$\frac{1 \times 1.75 \times 9 \times 310}{2{,}000} = 2{,}441 \text{ tons}$$

2,441 tons at $2.75 (local price)	$ 6.71
Add fixed charges, etc., as above	12.48
Total annual cost per I.H.P.	$19.19

This figure could be diminished to about $18 per indicated horsepower year, by charging to the non-power uses of steam a proper proportion of the operating charges.

Gas Engines and Producers.

For gas engines and producers, the cost of plant on the indicated horsepower basis was set at $67.50; the figure being reached as follows:

Two hor, doub. acting gas engines	$21,000
Two 300-kw. generators, 60 cyc., 220 v.	6,600
Two 38½-kw. exciter sets	3,000
Two producers	7,700
	$38,300
Add about 10 per cent. for freight and erection	3,800
	42,100
Foundations	1,100
	$43,200
Add about 10 per cent. for contingencies	4,300
	$47,500
Cost of buildings	20,000
Total Cost	$67,500

The cost of operating the plant was figured thus:

Fixed charges on plant, 14 per cent. of $67.50	$ 9.45
Attendance per I.H.P. per year	3.21
Oil, waste and supplies	.50
	$13.16

To this is added the cost of coal, which was taken as 2 pounds per kw. hour including stand-by losses, equivalent to 1.28 pounds per indicated horsepower hour. The total coal for an indicated horse-power year would, therefore, be:

$$\frac{1 \times 1.28 \times 9 \times 310}{2{,}000} = 1.786 \text{ tons}$$

1,786 tons at $2.25 (local price)	$ 4.02
This added to $13.16 gives the yearly cost of an indicated horsepower with gas engines as	$17.18

Steam Turbines.

Approximate cost for a steam turbine plant were these:

Two 300-kw. steam turbines with condensers, at $47 per kw.	$28,200
Boilers, $12 per kw.	7,200
Piping, flues, heaters, pumps, etc., at $7	4,200
Foundations, at $1	600
Chimney, at $4	2,400
Buildings, at $20	12,000
	$54,600
Cost per kw.	$90.00
Cost on I.H.P. basis	57.00

The conditions to be met by the three plants are not stated, although exercising an important influence oftentimes upon total costs.

NEW SAFETY DEVICE FOR ROLLS.

IN rubber factories and other industrial works where rolls are used for crushing and grinding, it is often necesary to feed the material into the rolls by hand. The operation is carried out with more or less danger to the workman, and he often suffers the loss of fingers, if not a hand, before the rolls can be stopped. A safety device for use in connection with such work has recently been placed on the market by the Dodge Manufacturing Co., Mishawaka, Ind., the construction and operation of which is shown in the accompanying illustrations.

Fig. 1 shows a line shaft for supplying power to rolls. This shaft running in extra heavy and rigid Dodge self-lubricating pillow blocks of the rolling-mill type, and carrying an iron centre wood-rim pulley and a 60 inch split friction clutch, is driven by the motor shown.

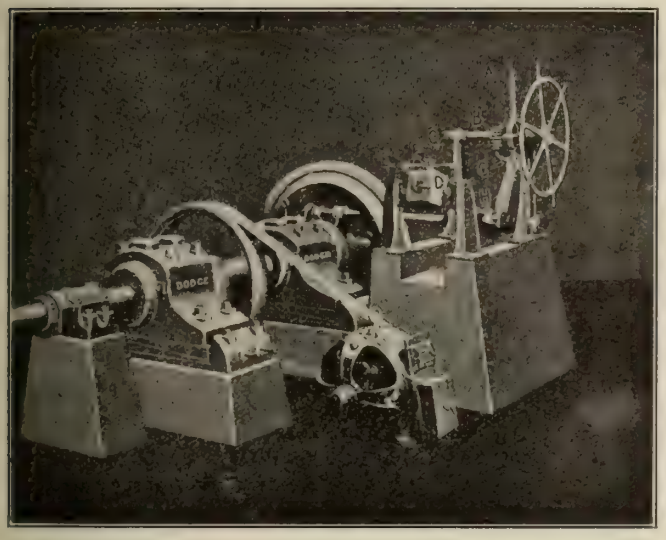


Fig. 1.—Safety Device For Use With Hand Fed Rolls.

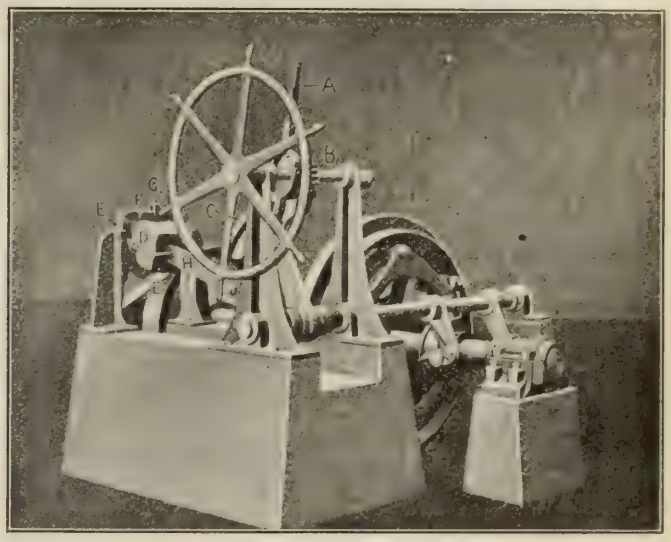


Fig. 2.—Safety Device Detail.

Referring to Fig. 2, a stout cord is carried from a point convenient to the roll operator by means of overhead pulleys to a pulley vertically above the point (G), and thence down to (G) where it is secured. In an emergency, the operator pulls the cord and this releases the heavy weight (D) which is held in position by the hook levers (E) and tripping links F. This weight (D) is carried on the lever (H), and when (D) is released, this lever moves rapidly downwards and strikes a lug (not shown) on the clutch-operating shaft, which promptly disengages the clutch. The large handwheel shown is employed in throwing the clutch into gear, it is disconnected from the mechanism by the shifting of lever (A) which slides the pinion (B) out of mesh with the toothed segment (C).

The device originally worked out for the Mishawaka Woolen Co., has operated with such success that it has also been adopted by the Rubber Regenerating Co. of the same city.—I.T.R.

WATER WASTE IN CITIES.

CURTAILMENT of water waste in cities is a problem of real importance not only to water-works engineers, but to every urban ratepayer. There is always a danger that any public utility which exists as a monopoly will be subject to excessive waste in its operation. This has too often been true of the water services in United States and Canadian cities, and millions of dollars, in the aggregate, are squandered annually by those cities, simply because of inefficiency in this branch of the public service. Water waste may be due to one or more of a number of causes, the chief of which are the following:

1.—Pump slippage, which implies that there is a loss of pump capacity, steam and fuel.

2.—All water-works plants, whether pumping or gravity, suffer loss in distribution through underground leakage from mains and services. Recent surveys in some leading American cities disclosed the existence of an immense number of underground leaks. In the city of Washington alone, in the past five years, a total of 30,000,000 gallons daily from about 3,000 underground leaks were found, chiefly in mains and service pipes.

3.—Then there is frequently serious waste due to defective plumbing, and "steals" by consumers who are provided with meters. These are each easily remedied.

4.—Lastly, one of the most serious wastes is due to the extravagant use of water by consumers. This class of "leak" is almost invariably found in cities where meters, or some other method of checking extravagance, are not in use. In this connection, the experience of Kalamazoo, Michigan, is instructive. During the year ending March, 1893, with a population of less than 18,000, no meters and 30 miles of mains, the total pumpage was 787,621,902 gallons, for which the department received $15,000. In 1912, with all the services metered, a population of 45,000, and 78 miles of mains, the pumpage was 696,898,797 gallons, and the revenue $42,773. A comparison of these figures shows that in 1912, when meters were used, the pumpage was 90,723,105 gallons less than in 1893 and the increase in the revenue amounted to $27,773. At the same time, the population of the city increased by 150 per cent., and the mileage of mains by 160 per cent.

Again, it has been found, both in American and Canadian cities, that very serious waste occurs as a result of defective pumps, mains or connections. During a pitometer survey, recently made, of the pumping stations and mains of a city of Eastern Canada, leakages were discovered aggregating 4,000,000 gallons a day, an amount equal to about 25 per cent. of the city's total consumption. A broken three-inch main to a disused foundry was found discharging full bore into a sewer, and this, with a leak in a one-inch service to the same foundry, caused a daily loss of 2,100,000 gallons. During less than three months, a total leakage of 4,000,000 gallons per day was discovered.

In this city is was also found that the gas works were using 125,000 gallons per day, but were only paying a flat rate of $245 per annum, whereas this quantity of water at the minimum meter rate of only 6 cents per 1,000 gallons should have produced a revenue of $2,737.50.

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GRADED CERTIFICATE EXAMINATIONS.

ON page 108 of the April issue of The Power House there will be found a number of observations by a correspondent, on what should constitute the subject matter of examinations for operating engineers, in the event of an Act being passed to establish a scheme of graded certificates in the Province of Ontario. The tenor of the article seems to point to a desire to have the examinations adapted to suit the operators. Like our contributor, we are disposed to think that, to the present generation of these, at least, the graded certificate examination requirements will come as a somewhat unpleasant surprise.

It is not, altogether, a question of what knowledge is absolutely necessary for a man in order that he may shine in his calling. We have all been taught much that, perhaps, has been of little or no service to us, at least we think so. Again, we all partake of much more food in quantity and variety than is required to keep us alive. Why, therefore, should we set our face against storing our minds with instruction bearing directly or indirectly on our craft? The very progress of the engineering profession and everything else pertaining to our civilization has been developed and brought about by men embracing and acquiring knowledge beyond their everyday need. The examinations for second and first class operating engineers will be absolutely worthless if they make possible a man securing the certificates of competency without a wide and comprehensive knowledge of his daily task, supplemented by other direct and indirect trade accessory data. The desire for graded certificates is to secure distinction of ability, and the higher the examination standard set, comparatively, between the different grades, the more effective will be the attainment of the object in view. Superiority of appointment would be no better than it is at present, if, under the new regime everyone could become a first class engineer straight away.

OVERRATED MEN.

IT will be at once evident that there exists little disposition to overrate what may be termed the rank and file of any business or enterprise, on the part of the employer at least, although there is quite a tendency apparent in a number of instances where labor is disposed to overrate itself. The disposition in the world of industry is to rate a man at his true value, and although betimes most of us consider the finding to be not altogether to our liking, it goes without saying that the error is, generally speaking, never a very grave one. It is a noticeable feature of our time, that a misjudged confidence in a man's ability and capacity meets with speedy correction, and the higher up the rank, the more noticeable the incompetency.

Little tolerance is displayed towards incompetency and inefficiency in manufacturing production and its kindred accessories, and to this attitude is largely due the high attainment and achievement recorded. Is it not possible then to have the same spirit pervade our public business undertakings; and need we go beyond the realm of municipal government to find out how far short the latter falls of reasonable performance? The root of the trouble is, we believe, to be found in the utter helplessness and incapability of the people's representatives, and while there are doubtless grades of the disease, and although some of our municipal bodies have higher percentages of a less virulent incapacity in their make-up, the fact remains that they all blunder, yes and blunder badly.

The City of Toronto, in the persons of its civic rulers, is a horrible example of uselessness and incompetency, being in many respects nothing short of a laughing stock to the civilized world. What wonder is it then, that, with the glaring lack of harmony apparent among its rulers, nothing undertaken can be brought to a successful issue. It would seem inviduous to select a particular example of failure, as none other but the latter term is applicable, yet, the palpable incapacity shown to compass the cleaning of the water supply tunnel across the Bay being of so recent a date, calls for special mention. In spite of the careful and persistent propagation of the idea that the head servants of the Corporation were "big men," "clever engineers," and the "men to do things," we have been shown in practice that they are otherwise. Further, it is amply evident that the men themselves and their employers fail to appreciate the situation. If industrial enterprise were on a like footing ,heaven help us all.

GAS AND OIL ENGINE PROGRESS

A record of principles of design, construction and achievement in a rapidly developing sphere of power generation.

GAS POWER TOPICS.

WRITING on "Gas Power Topics" in the columns of the Power User, Mr. W. A. Tookey points out that the most important lesson that has been learned throughout the history of the gas engine is that, according to the relative richness of the mixture of air and gas, so the rapidity of ignition is greater or less. In this sense the inflammation of the whole charge is referred to and not merely the commencement of such inflammation or combustion. It has been amply demonstrated that a mixture too rich in gas may refuse to ignite or may only be partially burnt. Another proportioning of air to the same quality of gas may result in violent and sudden explosions, while, should the air be greatly in excess, combustion may be extremely slow and irregular.

Other lessons that have been learned are that a particular mixture introduced into and ignited in a comparatively cold cylinder will burn relatively slowly, but if, by consecutive ignitions, such as occur on full loads, the heat of the cylinder be increased, the same quantity and proportioning of air to gas will result in much more rapid combustion. Again, it is found that a similar result is obtained if the mixture is compressed before ignition to a higher degree. The work of compressing done by the incoming piston results in the mixture becoming much more highly heated and in such a state combustion is much more rapidly effected.

A further lesson, taught by experience, is that the rapidity of combustion of a relatively weak mixture can be increased if the charge be "fired" before the compression stroke is actually completed.

LIQUID FUEL AND THE PRODUCTION OF POWER.

By W. D. Kirkpatrick.*

PETROLEUM, the chief, although not by any means the only liquid fuel, is well known to engineers to be a hydro-carbon, but so many, even among those who are familiar with this great natural product and most useful fuel, speak of it as "crude petroleum," therefore, a few words as to the composition of the oil used for the production of power in steam boilers or industrial furnaces, as distinct from that employed in an aeroplane Gnome engine, or a kerosene paraffin lamp, will not be out of place.

Crude oil as it comes from the well differs but little in its ultimate composition. It is believed, to quote Professor Vivian B. Lewes, to be of marine organic origin, probably the result of the great natural process of carbonisation which has converted other forms of vegetable growth into coal; but this is another subject. This crude oil, although it is composed of practically the same elements, has a specific gravity which varies between wide limits.

The Paraffin Series.

The first member of the paraffin series —methane, CH4 or marsh gas, is an extremely light gas, and the next—ethane—is also a gas of similar character, but a little heavier. The third and fourth members of the series still remain gaseous; from the fifth to about the fourteenth are the true oil liquids, getting, however, more heavy and less volatile the greater the number of atoms in the molecule, so that by the time the fifteenth member is reached we have what might be described as semi-solids, such as vaseline. Above this point we commence the series of true solids, which include paraffin wax and other such products. Each step in the series, in addition to making an advance in the specific gravity, also makes an advance in the boiling point, so that whilst "pentane" has a specific gravity, of .64, and is volatilized below the ordinary air temperature, by the time "Decane" is reached, the tenth member, the specific gravity, has risen to .751, and the boiling point to 162 deg. C.

The gaseous members of the group are those which cause oil spouters. These gases accumulating in the vast deposits of oil become so compressed that when the oil strata is tapped the oil spouts with great violence, and pressures as high as 1,900 lbs. to the square inch have been recorded. The increase of the specific gravity is accompanied, as stated, by a corresponding increase in the boiling point, which permits of the crude oil being distilled at slowly rising temperatures, and the distillates which are given off having similar properties, they can be very easily fractionated into products fitted for the various purposes to which they may be applied.

The first series which are obtained up to a temperature of 150 deg. C. constitute what are technically known as "benzines," all of which may practically be termed "motor spirits" or "petrol." From 150 to 300 deg. C. we obtain what is known as "kerosene," or lamp oil, which, it is well known, is being applied with great success in many internal combustion engines. Practically all fire engines which are fitted to burn liquid fuel use the less refined kerosene, whilst the oil obtained after these fractions have been distilled is the portion used and known as "liquid fuel for steam raising and furnace work," or for further distillation to produce lubricating and heavy oil. It is commercially known as "residuum oil."

To turn back for a moment to the specific gravity of these fuels, we find the crude Pennsylvanian petroleum as it comes from the well to have a specific gravity of .801. This, it will be readily seen, must consist largely of the earlier members of the petroleum group, and it is, therefore, safe to predict a good yield of motor spirit and paraffin, whilst if the crude product has a specific gravity exceeding .9 the relative yield of spirit would be low, but the proportion available for liquid fuel high.

What has been said serves to answer a question which is so often asked by intending users of liquid fuel apparatus, namely, "Is there any danger to be expected from the storage of the fuel?" This "residuum" oil, being divested of all volatile spirit by distillation, can be safely stored in positions where it would be extremely dangerous to attempt the storage of crude petroleum,

*Kermode's, Ltd

as with the material we are considering, practically no inflammable gas is given off until comparatively high temperatures are reached, certainly well above 150 deg. C.

Turning now to the second portion of cur subject—namely, the steps which have led to the present systems of oil firing, the problem to be solved is, how best to utilize the largest proportion of the heat which is contained in the oil for the production of power. The earliest practical attempts to do this were naturally done at the oilfields, where it was realized that if the oil could be economically burnt and used in the distillation processes, much economy would be effected. Let it be noted, however, that these attempts were made with crude petroleum, and to this fact is due much of the early success which these experimenters obtained. In the Russian fields, Nobel succeeded in getting very excellent results by fitting a series of troughs, one below the other, across the front of the mouth of the furnace of Lancashire boilers. The crude oil was allowed to drip into the uppermost of these troughs and overflow from one to another through the series, and, as this crude oil contained a considerable percentage of the light volatile spirit it burned fiercely, the flames were sucked by the draught in the chimney, and evaporation as high as 13 lbs. and even 14 lbs. of water per lb. of fuel were obtained. It will be clear, however, that an application such as this could only be used for a stationary boiler.

Later attempts at oil burning consisted of various forms of apparatus designed to gasify the fuel prior to its entry into the combustion chamber, many different forms of apparatus of this character being used with varying success in the United States. It was, however, found that this method of using oil fuel resulted in the tubes and combustion chambers of the boilers on which it was applied, after quite short periods of steaming, becoming absolutely choked up with carbon deposits.

Considerations to be Accounted.

When we examine the question of using oil fuel for the production of power, other considerations, apart from the requirements of coal firing, are necessary. First, it must be recognized that perfect combustion can only take place at a high temperature, coupled with an adequate supply of air, or rather oxygen. The fuel to be dealt with being liquid, when introduced into the furnace in troughs, for example, only presents a comparatively small surface for combustion, and it, therefore, becomes evident that some form of spray must be used. Further, in order that every portion of the fuel shall have access to the surrounding air, this spray must be a finely divided or atomized one, and the present practice of liquid fuel burning, therefore, resolves itself into the most efficient means for this purpose.

Methods of Atomizing.

There are three different methods at present in use by which this atomizing can be efficiently carried out—the air jet system, the steam jet system, and the pressure jet system respectively. The air jet system recovers from 78 per cent. to 83 per cent. of the actual theoretical calorific value of the oil fuel for useful work. The steam jet system is capable of reproducing from 70 per cent. to 75 per cent., and the pressure jet, or naval system, from 75 per cent. to 83 per cent., according to the conditions under which it is used.

Design of Boiler or Furnace.

Having thus briefly shown the different methods of dealing with oil fuel, we must turn for a moment to consider the problem from the point of view of the design of the boiler or furnace in which it is to be used. There is a prevailing belief that to consume oil as a fuel presents no serious difficulties, it being only necessary to convey the oil to the furnace, and, provided efficient sprayers are used, the arrangement can be completed by almost any person who has given the subject an hour's consideration. This, however, is far from being the case, for the arrangement of all the various fittings, which, when assembled, constitute an oil fuel plant or equipment, known commercially as a "system," capable of producing higher results in completely atomizing the oil fuel, and one which will successfully compete with the high efficiencies secured from the better grades of coal, especially when handled with mechanical stoking devices, can only be designed and erected with great care by those who have had special training and long years of actual contact with the business. The successful application of oil fuel to boilers and furnaces is strictly an engineering feature, and its design should, therefore, in no case be given to anyone who is not familiar with the subject in all its details.

The Flame Feature.

In examining the flame which is produced in any combustion chamber or furnace, we find that violet colored glass gives the best result from a scientific point of view, because it absorbs all the rays, excepting in most instances those which are situated above the ultra violet in the spectrum, or, in other words, it paints the picture as badly as it is possible to do so. In a furnace in which the question of design has not been carefully considered a red colored glass will probably show the flame to extend as far as the back of the combustion chamber. If, however, the violet glass is applied, the flames will be seen to be but comparatively short, and above and beyond the actual luminous flame a dark colored system of partly consumed gas, soot laden and murky, will be apparent.

If we now transfer our observation to a properly designed combustion chamber, and apply the violet shade, no nonluminous areas will be seen, but in the mass of flame, dark streaks will be apparent. These can be traced to the point of disappearance, and if a glass having more blue and less violet is substituted, even these patches would be seen to emit some radiance. This method of observation is extremely useful, and serves to show clearly the effect of good and bad design when applied to furnaces. It should also be a conclusive answer to those people who persistently argue that smoke is an unavoidable product of combustion, whereas it is only the result of careless design and failure to apply the principles of scientific knowledge to practical application.

In the combustion of a hydro-carbon, such as "residuum" oil, we find that the hydrogen ignites much more readily than the carbon and at a much lower temperature, and the probability is that if the designer of the furnace has not very carefully considered this element, it will, as it were, absorb the whole of the available oxygen from the surrounding air, and deprive the carbon from any opportunity of combustion, thus causing it to become a deposit in the form of soot in the uptake to be given off as smoke from the stack. To prevent this carbonization of the fuel during the processes of combustion must be the aim of the designers.

As a rule, the boiler manufacturer or furnace builder completes his boiler or furnace without a thought as to the suitability of the one or the other for the fuel he ultimately intends shall be used. With individual boilers generating as much as 8,000, 9,000, and even 10,000 h.p. per boiler, the application of the fuel to produce such a result smokelessly, which, of course, means efficiently, presents difficulties not lightly disposed of. In most instances, had the matter of the fuel to be used been considered at the time the design was first taken in hand, the difficulties of the problem would reduce themselves by one-half.

For dealing with Mond gas tar, a special system has been devised, which is of the utmost value to users of the Mond gas plant. For some time past this almost worthless refuse has been utilized as liquid fuel on the boilers which supply the Mond gas plant with steam, and by this means a considerable saving is effected in the fuel bill.

(To be continued.)

ELECTRICITY AND HYDRAULICS

This department is intended, in addition to individual treatment, to feature the close relationship existing between electricity and hydraulics in the power and light field.

LARGEST COMMERCIAL SWITCHBOARD IN THE DOMINION.

THE C. P. R. Windsor Street Depot, Montreal, has the honor of having installed the largest telephone switchboard in the Dominion—that is, it is the largest commercial switchboard, its capacity being for twelve hundred lines.

The telephone room is situated in the old tower. It is well lighted and ventilated, and of such a size that if it be necessary at any future time to extend the switchboard, ample room for such extension is provided. In arranging this important department the company has had the comfort of its employees in mind and a special rest room has been prepared immediately above the operating room. This is being furnished with easy chairs, sofas and reading material, and everything has been done to make their quarters comfortable and homelike.

The new switchboard is what is known as the No. 4 Lamp Signal Multiple Board, and has a great many improvements which were lacking in the old one, such as lamp line signals, audible busy tests and lamp disconnect signals. At the present time it takes eight operators to handle the business, and has an ultimate capacity for ten positions. The board has been divided into two sections, the first four positions handling originating business and the other four the incoming business. Each position consists of two panels, making sixteen for the whole board.

At the moment, the board is wired for 500 local lines and 100 trunk lines, the limit capacity as stated being 1,200 lines and 160 trunk lines. There are 225 local lines in use and 50 trunk lines, which will shortly be increased by 50 and 40 respectively. During one day a total of 7,180 calls were handled, an average of 900 calls per operator per day. Quite recently, one hour tallies showed that 1,028 calls were disposed of. This tremendous number of calls necessitates an exceedingly fine class of operators, and those at the C. P. R. under the jurisdiction of the Telephone Company have been specially and thoroughly trained in every phase of the business. The majority have had years of experience with the C. P. R. and its officials and employees.

The board is operated from 8 a.m. until 10 p.m., including Sunday, and in order to maintain these hours and make allowance for reliefs and days off when working on Sunday, a staff of twelve operators and one supervisor are needed all the time.

ROTARY CONVERTER OPERATION.

IT is often stated that rotary converters work unsatisfactorily when used on circuits having a periodicity over 25 cycles per second, but it appears that two 1,000-kilowatt 60-cycle 12-pole compound wound rotaries without commutating poles have been running successfully for over a year in a sub-station of the Housatonic Power Co. They are wound six-phase, and work in parallel with four 500-kilowatt rotaries on a traction system. Line current at 33,000 volts is transformed to 430 volts. The transformers have two 2½ per cent. full capacity taps above, and two below 33,000 volts in the primaries, and one-third and two-thirds voltage starting taps in the secondaries. They have 15 per cent. inherent reactance. The rotaries will carry 50 per cent. overload for two hours, and 100 per cent. momentarily. The brushes are of a composition of copper and graphite. Speed-limiting gear is provided.

FIRST AID AFTER SHOCK.

HOW to save the life of a victim of electric shock is the subject of a chart and pamphlet issued by the Commission on Resuscitation from Electric Shock. This committee, of which Dr. W. B. Cannon, of Harvard, is chairman, represents the American Medical Association, the National Electric Light Association, and the American Institute of Electrical Engineers. A copy of the code of rules for resuscitation has been sent to every member of the three organizations.

The commission set out to solve three problems:—First, what course the layman should pursue who finds a person unconscious from electric shock; second, the invention of a mechanical device for artificial respiration, and, third, to investigate "the possibilities of restoring the fibrillating heart to its natural pulsation."

Device for Artificial Respiration.

The above mentioned set of rules is the answer to the first question, and Dr. S. J. Meltzer, of the Rockefeller Institute of Medical Research, has all but completed the invention of a device which has restored the respiration of cats and dogs. Tests on human beings are now being made.

Artificial respiration should be begun before any attempts are made to loosen the subject's clothing, although this may be done concurrently. The rules state that the artificial respiration should be continued without interruption for at least two hours, or until a doctor arrives, and no liquid should be introduced into the patient's mouth until he is fully conscious.

Some "First Aid" Rules.

The "first aid" rules direct the rescuer—first, to break the circuit without receiving a shock himself, this being done by a single quick movement. The rule on this point says: "Use a dry coat, a dry rope, a dry stick or board, or any other dry non-conductor, but beware of using metal or any moist material." The rescuer should use only one hand, if the aid can be practically so administered, and he is advised against touching the soles or heels of the victim's shoes while in contact, because of the nails in the shoes. Rubber gloves or rubber cloths form the best protection while handling a victim of shock, but if there is no time to get these, dry cloth will answer. If the victim is conducting the current to ground, and is convulsively clutching the live conductor, it may be easier to shut off the current by lifting him than to leave him on the ground and try to break his grasp. The quickest way to

break the circuit is by opening the nearest switch.

The actual method of resuscitation is the Schafer, or "prone pressure" method, and begins by laying the subject on his stomach, with arms outstretched in front of him. The rescuer kneels, straddling the victim's thighs, and facing his head.

ELECTRICITY AT CAPE BRETON COAL MINES.

THE coal mines in the Cape Breton district of Nova Scotia, are rapidly adopting electricity for their motive power. A new turbine station is being built to generate 6,600 volts at 25 cycles. To prevent the power factor from falling below 80 per cent., some 600 horsepower synchronous motors driving air compressors are made to take a leading current by field adjustment. These motors are started as induction motors from auto-transformers with high-pressure oil switches having a large overload capacity.

A large hoist situated near the new generating station, handles 1,200 tons per ten-hour day, the haul being made on a 22.5 per cent. gradient 4,500 ft. long. The total gross weight of 30 cars per trip is 82,500 lbs. For this work, use is made of a direct-current motor mounted on the winding drum shaft and supplied with energy from a motor generator. This motor has an intermittent load rating of 1,600 horse-power, and operates normally at 50 revolutions per minute. In the near future, two more electrical coal hoists of the same character will be put in use, and will haul 24 cars up a 32 per cent. gradient at a maximum speed of 30ft. per second. The gross weight per car will be 2,900 lbs., and the length of the slope between 3,000 ft. and 5,000 ft., with an output of 1,200 tons in eight hours. In order to diminish the load at starting, the cars in this mine will not be started on the gradient, but from a level stretch of track laid at the working face of the mine.

MODERN METHODS OF ELECTRIC WIRING.

IN a recent paper on "Modern Methods of Electric Wiring," Mr. Frank Broadbent points out that for moist, steamy, and wet places, good lead-covered cables, properly installed, are hard to beat for durability and absence of leakage troubles.

It is, however, no use going to the expense of lead-covering and assuming that this is the end of it, and that it does not matter how the cables are erected and protected. Lead is a soft metal and is not self-supporting, so that, unless adequately carried throughout its length, it will, sooner or later, give trouble. To cleat lead-covered cables up to a dead wall or to suspend them from insulators just as one would support unsheathed cables is simply a waste of good material. Lead has the very useful property of forming insoluble compounds with certain acids, and a thin coating of these forms a protective covering and renders the lead sheathing impervious to further chemical action. Tannic acid is, however, not one of these acids, and lead in its presence is readily attacked, and so is unsuitable for use in tanneries or for running underground near tree roots, unless specially protected. Acetic acid is another acid which has an affinity for lead, hence lead-covered cables should not be used indiscriminately in breweries and vinegar works.

SUN POWER.

AT the fourth ordinary general meeting of the Sun Power Co. (Eastern Hemisphere), held recently, Mr. Shuman mentioned that when the Cairo plant was first started it worked as easily as any steam engines did for the first few days, and the engineers were satisfied with the results. After three days, however, the zinc boilers, owing to the heat of the sun, softened. They could not stand the increased temperature, and consequently the plant had to be stopped. It was believed that a temperature 200 degrees higher was obtained in Egypt than in America. That, however, did not discourage them, although it was disappointing to lose time, for they knew that they could construct boilers which would take higher temperatures, so they put the plant in charge of an engineer and proceeded to construct cast iron boilers which would stand the heat. They expected to have those boilers put in by May 15th, and to have the plant in full running order by June 1st. In future, however, the boilers would be pressed out of a single piece of steel tubing. The reason why cast iron boilers had been installed was on account of the facility with which they could obtain them.

When the sun got to work on their reflectors at six in the morning they would have steam by 6.15. If they got the sun to work on water in the boilers at noon they would have steam in three minutes. A sun-power plant could be built of any size from 25 horse-power up to 100-000 horse-power, or even larger. If they wanted more power, it merely meant covering a larger area. For every acre of ground covered they could obtain 250 horse-power, so that if they wanted 1,000 horse-power they would have to cover 4 acres, and so on.

REINFORCED CONCRETE WATER TANK.

A REINFORCED concrete water tank and tower have recently been constructed at Berlin, Ont. The tank has a capacity of 600,000 gallons when the waterline is 2 ft. below the top. It is 50 ft. in diameter, 40 ft. high, and is formed of a circular shell 12 in. thick at the bottom and 8 in. at the top, standing on a reinforced concrete tower 81 ft. high from the footings of the foundation. The tank is covered with a flat arched dome of reinforced concrete 4 in. thick, and the bottom is made up of two domes which run into each other, the outer one being inverted, with its low part resting on the supporting tower, from which point springs the inner dome, which is convex to the inside of the tank. The bottom is well reinforced to prevent bulging. The inner and outer domes of the bottom are so proportioned that the thrusts nearly balance. The thrust at the junction of the bottom and the shell of the tank, due to the weight of the shell and its roof, is provided for by a large amount of steel reinforcement.

The tank reinforcement consists of ⅞ in. and ¾ in. square bars of high carbon steel, placed in two separate layers where the spacing was less than 4 in. In the inner dome of the bottom there are ½ in. rods spaced from 6 in. to 8 in. apart, centre to centre. Concrete, mixed in the proportion of 1: 1: 2, was used in all portions of the tank in contact with water, whereas the proportion in all other places was 1: 2: 4. As a means of waterproofing the tank, three coats of mortar, gauged 1 of cement to 1 of sand, and laid on ¼ in. thick, were used.

U. S. ELECTRIC POWER OUTPUT.

THE combined electric output of the 7,500 central stations in the United States for the year ended December 31, 1912, was 12,000,000 h.p. While this amount is, of course, large, it is only a part of the total electric power generated, as it includes only public service companies and takes no account of the great railroad and manufacturing companies which produce and use their own power; the total power generated is, therefore, easily double the output of the central stations.

There are few shops where money could not be saved by detailing a man to inspect regularly the line shafting and similar parts through which power is transmitted.

REFRIGERATION

DEPARTMENT

INSULATION AND REFRIGERATION.

By Horace C. Gardner.

AMONG the early methods of insulation within the writer's experience was the double-wall method, still well-known and considerably used where land values and space available do not prevent. An early plant built in East St. Louis had three walls and two spaces, both stuffed with sawdust. This insulation was very effective, and when the building was torn down in 1893, was found to be in good condition, although the walls were too thin and had buckled badly.

About fifteen years ago, one of the old pork warehouses built and used by the late B. P. Hutchinson, was remodeled and the insulation removed. This insulation was found to be composed of vertical studs set with their faces ten inches from the brick wall. Common boards were nailed on these studs with paper back of them and the space was nominally filled with sawdust. A considerable portion of the space was found to have been filled with second salt. The house had given good service, although it is not fair to conclude that the insulation was highly effective.

Fundamental Qualities of Insulation.

In considering the adoption of any kind of insulation, it is well to deal specifically with the fundamental qualities that ought to be included. Among these may be mentioned the following:

(A)—The heat resisting qualities must be high.

(B)—A waterproof material is desirable, or at any rate a material that does not absorb and retain moisture readily.

(C)—The material must be free from odors.

(D)—It should be vermin proof

(E)—The material should not be subject to rapid decay.

(F)—An ideal material would naturally be fireproof; at any rate, fire resisting quality is desirable.

(G)—For use in refrigerator cars, some flexibility, also some mechanical strength is essential.

Old Theory of Meat Refrigeration.

Twenty odd years ago there used to be prevalent the theory that great care was necessary not to refrigerate warm carcasses too rapidly. With modern ammonia refrigerating machinery, and the usual methods of applying refrigeration, there is no danger in this respect; in fact, it is quite desirable to refrigerate quite rapidly. The old theory doubtless grew out of peculiar conditions in connection with the Australian frozen meat industry. The earliest refrigerating machines successfully used in this trade were of the cold air type, in which the air was compressed and cooled under pressure, and then expanded and directed into refrigerating rooms. The writer has seen temperatures of 60 degrees below zero F. at the outlet box of these machines on shipboard. Of course, this exceedingly low temperature was only local, but it doubtless was true in a few cases that meat was frozen on the exterior with such great rapidity as to seal up the pores and prevent the escape of some gases that by the ordinary refrigeration process leave the warm meat within the first few hours. The writer has never seen a case where harm was done by too rapid refrigeration, but has had cases so specifically described that he is convinced there was in the early history of the meat freezing business, some experience of this kind. Meat intended to be frozen should be refrigerated in the ordinary manner for the first twenty-four hours. The exterior moisture should be gotten rid of quite thoroughly, and then the freezing should be done immediately and rapidly. Do not fear to do it too rapidly.

Methods of Applying Refrigeration.

There are three general methods now in common use for taking heat out of refrigerated spaces, or of applying refrigeration to rooms in which meat products are handled. They may be described as the direct expansion method, the brine pipe method and the open brine sheet or curtain method; the last named being an invention of the writer of this article. These methods all have their advantages and disadvantages, and should not be considered strictly as equivalents. It is the writer's firm belief that the open brine sheet method is the best for the initial refrigeration of warm carcasses. Experience has shown that the vapors coming off the warm product are rapidly absorbed, and the air is maintained at the most desirable state of humidity; that there is rapid refrigeration without undue drying, and that the air is largely purified by coming in contact with the wet surface of the sheets.

Direct expansion of ammonia through pipes and circulation of cold brine through pipes are strictly equivalents for maintaining temperatures in ordinary meat-curing rooms, and which is the more desirable in any given case can be determined only by considering the whole plant and its needs, the general idea being to avoid unnecessary complications. For example, the wholesale house using refrigeration merely for the receiving and care of product already chilled, and not requiring open brine refrigeration, can get fully as good results with direct expansion of ammonia, and avoid the expense of brine tanks and brine pumps. Against this is to be weighed the disadvantage that there is no reserve capacity in case of a shut-down, whereas, with the cold brine pipe method, there is always a stock of cold brine that may be circulated for a time. If a plant must have brine for chill rooms, it is better to use brine also for the warehouses.

The liability to ammonia leaks must be kept in mind. The writer has successfully used dry expansion of ammonia in freezers where delicate products have been stored. Even eggs have been and are successfully refrigerated by this method. It is obvious, however, that the risk of ammonia fumes permeating the product is much greater than the risk of loss by any ordinary brine leak. Of course, for low temperature, the brine would be chloride of calcium, and while this is not poisonous, it has a bitter taste and damages product, whereas ordinary brine leaks do little or no damage to the product.

Recurring here to the open brine sheet method, this is only practicable with chloride of sodium brine, as calcium brine has too high an affinity for moisture and dries the air too much.

Use of Brine and Circulation of Air.

Where refrigeration is to be applied to chill rooms by the open brine sheet method, and where meat curing rooms or other cold rooms requiring non-freezing temperature are situated in different storeys of the same building and below the chill rooms, or even in other buildings but at lower levels than the chill

rooms, it is frequently practicable to refrigerate these curing and storage rooms with brine pipes, allowing the return brine from the chill rooms to flow through them by gravity on its way back to the brine tanks. This is desirable because it saves brine pumping; it also brings the brine back to the brine tanks with a greater temperature spread.

For chill rooms and sharp freezers proper circulation of the air is essential. Experience has shown that the best results are obtained by having refrigerating chambers above the meat rooms and freezer space, depending upon the natural circulation; the warm air going up through flues and passing over the refrigeration spaces and thence down through other flues and over the meat. With proper proportion of flue area and proper height in the refrigeration chamber, the finest results are obtained in this way. It has previously been pointed out that there is practically no danger of chilling and freezing too rapidly. In freezing beef, the color is much better if moderate natural circulation be maintained and freezing be done with great rapidity.

Ammonia Gas Tension.

The application of refrigeration to sharp freezers by means of direct expansion of ammonia piping requires special attention to the ammonia gas tension, if the best results are to be secured. A little study of the boiling points of ammonia at various pressures will show the reason for this. In many establishments it is desirable to have a special ammonia compressor taking its suction from the freezer pipes, and either compressing the ammonia to the liquefaction tension or to the same pressure as the suction of the main compressors, and discharging its gas into the main suction pipes. Which of these alternatives is better in any given case can only be determined by a careful study of the whole refrigeration power problem.

It will be seen by the foregoing that the problem of the application of refrigeration in any meat establishment involves a careful study of all of the classes of work to be done and results to be obtained. After such study, a choice should lie in favor of the method that will meet the prime necessities of the business adequately, and lend itself most readily to the casual or secondary needs with the least amount of complication. If the brine is to be used for the chill rooms it will be best in many cases to use brine for the whole plant. On the other hand, if some of the necessary conditions can only be met by the use of calcium brine or direct expansion, and if the carcasses to be chilled are not to be kept long, but are for prompt consumption or to go into cure, it is frequently better for the sake of simplicity to use the calcium brine or the ammonia direct through pipes for the chill rooms also. From a paper read at the Annual Convention of the American Meat Packers Association.

GROUP OF ENGINEERS, OWEN SOUND LODGE, C.A.S.E.

THE EFFICIENCY OF KIESELGUHR.

IN THE Dominion Express Building, Montreal, considerable trouble was experienced owing to excessive radiation from the boilers and piping system. The boiler room, of course, is in the basement, measures 60 x 100 feet, and on the floor above it is a finely appointed cafe and restaurant. The tremendous heat from the boiler room threatened to burn the cafe, and the architects decided that a suspended ceiling over the boilers was necessary. However, before adopting this expensive expedient it was thought best to attempt to ameliorate conditions by increasing the thickness on the boilers and steam pipes. These had originally been lagged with an asbestos preparation, and the resulting temperature over the tops of the boilers was as high as 190 degrees Fah. To remedy matters the preparation known as Kieselguhr was applied on top of the asbestos, a thickness of 4 inches being applied on the boilers and 1 inch on the steam pipes. The result was entirely satisfactory, the temperature over the boilers being brought down to 125 degrees Fah., —a reduction of 65 degrees.

Kieselguhr, we are informed, is infusorial earth formed from minute plants having a single cell and known as diatoms. Diatomaceous earth is practically pure silica and absolutely indestructible, being unaffected by heat under 3,500 F. It offers great resistance to transmission of heat or cold, and is thus admirably adapted for use as an insulating material for ice houses, cold storage plants, refrigerators, boilers, steam pipes, dwelling houses, etc. Its use in Germany and other European countries has been very extensive for a long time, although it is only during the past two years that it has been introduced into the United States and Canada. It is supplied in the form of a powder, being mixed to a paste with water, in which form it is readily applied to the surface to be coated. The head office of the Kieselguhr Company of Canada, Ltd., is at 520 Traders Bank Building, Toronto.

MAIN STREET OF OWEN SOUND ON A GALA DAY.

THE OPERATORS' VIEWPOINT

Devoted to brief descriptive article contributions covering ideas and experiences pertaining to power plant practice and operation. We pay for accepted material.

A SIMPLE INDEXING AND FILING SYSTEM.

By D. O. Barrett.

SUBSCRIBERS to present day Technical Journals are sure to find something in them desirable for future reference. If the articles are left in the original publications, they soon become too bulky, and the process of locating one of them consumes too much time. The only possible means of keeping up-to-date and following the trend of development along any one line being through the numerous periodicals received, the importance of properly filing articles so that they may always be ready for future reference is shown by the various methods employed for this purpose. The method here described is very simple, and, after once being tried, is its own recommendation. The necessity for something of this kind is felt by all, even the most humble mechanic, as he is sure to see something in his monthly paper that he knows he is likely to need later on and which he cannot remember, yet, when the time comes, the article has been mislaid, and all he has is a memory of something gone and forgotten as well.

Basis of the System.

The basis of this system is ordinary letter files of the box type, costing from twenty-five to forty cents each, and, if desired, one need not be purchased until the others are all full. Being dust proof, they need not be kept in a case for protection; they will also stand a considerable amount of rough usage. These files are divided inside alphabetically, when purchased, and are numbered as added. For important subjects, such as machine tools, foundry work, patterns, gas engines, tractors, etc., it is well to set aside a complete file, so as to keep, as nearly as possible, all articles of a kind together, although this is not at all essential to the operation of the system. It is not even necessary to keep an article bearing on a certain subject in the file covering that subject as it can be as readily found in any other. The articles are first cut from the magazine and the different leaves comprising them either pasted or fastened together with clips. Whenever there is much matter to be taken from one magazine, it is better to remove the staples at the back, as the leaves may then be more readily taken out, besides there is more room for pasting or fastening.

Routine of the System.

The title of the article which is desired for reference is underlined with a red pencil so that it may catch the eye immediately, and in the upper left hand corner are marked the number of the file and the letter under which it is classified, and in the right hand corner is marked the number of the article under that letter. For instance, an article on machine tool design marked (15)—(C) in the left hand corner and (6) in the right hand corner would indicate that it was the sixth article under the letter (C) in file 15. In this manner every article finds its way back to its original place regardless of the person using same. It is not necessary to have the title marked on the outside of the article, should it occur on an inner page.

Of course, this necessitates a card index, and there is nothing simpler or better after having given it a trial. It saves much useless handling of material, as one can skim over the cards in an index in the time it would take to get down and open a file. Then, again, several articles may be indexed under the same heading and on the same card, although in entirely different files. The cards are written in the following form, ordinary 3in. x 5in. cards being used.

17—A5—Machine tool design, F. R. Johnson. (Photos)—Bearing especially on lathe design.
Canadian Machinery, Jan. 15, 1913.

9—N3—A new boring mill design, editorial. (Drawings).
Mech. World, June 5, 1911.

On the card is noted whether there are drawings, illustrations, photos or other particular nature of the article.

By using a card index, one is enabled to cross-index, and this should be done freely, as an article may bear on several subjects, and the person hunting for information may not remember to look under some closely-allied title. Then again, others may desire to use the index, and may consider that the subject should more properly be classified under some other heading. The cards are classified under headings and sub-headings, such as machine tools, machine tool design, machine tool operation, machine tool tests, etc. Articles not in the possession of the owner of the index, but which are likely to be wanted for reference, should be listed the same as the others, omitting the file numbers of the cards.

This system has been given a thorough tryout, and anyone practising it will appreciate the advantages it has over some of the more complicated systems in use.

C.A.S.E. CONVENTION NEWS.

EVERY day finds the C.A.S.E. annual convention nearer, and before we know it the mayor and corporation of the picturesque town of Owen Sound will be welcoming the engineers with open arms. Reports say that Mayor Lemon is a much sweeter man than his name would indicate. Preparations are going along in a manner that promises well for the convention. Manufacturers appreciate the opportunity of presenting their claims to the engineers of the country, and are advertising lavishly in the annual souvenir. This is in charge of Mr. John Snowball, an engineer with some spare time on his hands, and an indefatigible worker. We show in this issue two views of Owen Sound, one of the main street and the other of the harbor. They clearly indicate that it is a business town.

The Exhibitors' Association of the C.A.S.E. is also actively at work. Its purpose is to co-operate with the engineer and his employer in securing greater economy in the power plant.

The supply men recognize that the C.A.S.E. Convention affords them an opportunity of meeting engineers in a combined social and business way, not possible under any other circumstances.

MR. JOHN SNOWBALL,
In charge of Convention Souvenir.

The city council have granted the city hall to house the exhibits.

Executive Officers, Exhibitors' Association.

Honorary President, Ernest Hooey, 1524 Fifth Ave. West, Owen Sound; Past President, E. F. Hetherington, Goldie & McCulloch Co., Galt; President, J. E. Fiddes, James Morrison Brass Mfg. Co., 93 Adelaide St. West, Toronto; First Vice-President, E. A. Wilkinson, Lunkenheimer Co., Toronto; Second Vice-President, B. M. Walthall, c|o Quaker City Rubber Co., 629 Market St., Philadelphia; Secretary, G. C. Keith, The Canadian Manufacturer, Toronto; Assistant Secretary, J. N. Charles, Canadian Fairbanks-Morse Co., Toronto; Treasurer, H. V. Tyrrell, The Power House, Toronto; Chairman of Exhibits Committee, E. F. Hetherington, Goldie & McCulloch Co., Galt; Chairman of Entertainment Committee, C. P. Archibald, 112 St. Peter Street, Montreal; Chairman of Reception Committee, C. F. Heitzmann, Peerless Rubber Co., 16 Warren St., New York.

OWEN SOUND—BIRD'S-EYE VIEW OF THE TOWN AND HARBOR.

W. T. Blaney will take charge of the mechanical department of The Motor Street Cleaning Co., of Windsor, Ont. The firm is commencing the manufacture of a motor vacuum street cleaner.

GROUP OF ENGINEERS, OWEN SOUND LODGE C.A.S.E.

PROGRESS IN NEW EQUIPMENT

There is here provided in compact form a monthly compendium of the power plant manufacturers' achievements.

A NEW PAPER MILL ENGINE.

THE fundamental requirements of a variable speed paper mill engine are a speed range equivalent to the desired speed range of the rolls, and, as nearly as possible, perfect regulation at all speeds. The usual type of paper mill engine has two horizontal cylinders with cranks at an angle of 90 deg. The range of speeds obtainable is, however, limited, because the unbalanced reciprocating forces prohibit operation at high speeds, and because, below a certain speed, the turning effort becomes uneven and the fly-wheel less effective in evening out the speed, thus setting a low limit below which regulation is seriously impaired. An engine of this type would have speeds from, say, 75 to 300 r.p.m., depending on the size and giving a range of 4 to 1.

Where a wider speed range is wanted, some form of speed change gear must be placed between engine and shafting. The simplest gear is a belt and pulley arrangement, and this in connection with two cylinder engines has proved a reliable paper mill drive. The drawbacks, however, are that the arrangement of pulleys and belts complicates the plant, consumes power, increases attendance and maintenance, and involves loss of time in changing speeds. Ordinarily, it requires from one to two hours to change over from one pulley to another, and, since it is necessary to shut down the plant while doing this, there is a loss of output amounting to one or two per cent., if the speed has to be changed, say, once a week.

Influence of Reciprocating Forces.

The secret of engine design for wide speed range on paper mill drives is to arrange the cylinders and design the reciprocating parts and counter-weights so that the reciprocating forces are neutralized. It is an erroneous impression that counter-weights attached to the heel of a crank will neutralize reciprocating forces. As a matter of fact, a counter-weight on a horizontal engine merely transfers the thrust from a horizontal to a vertical plane, thus causing a direct impact on the engine frame and on the foundations, instead of a sideways or lateral push. In slow speed engines these unbalanced forces can be

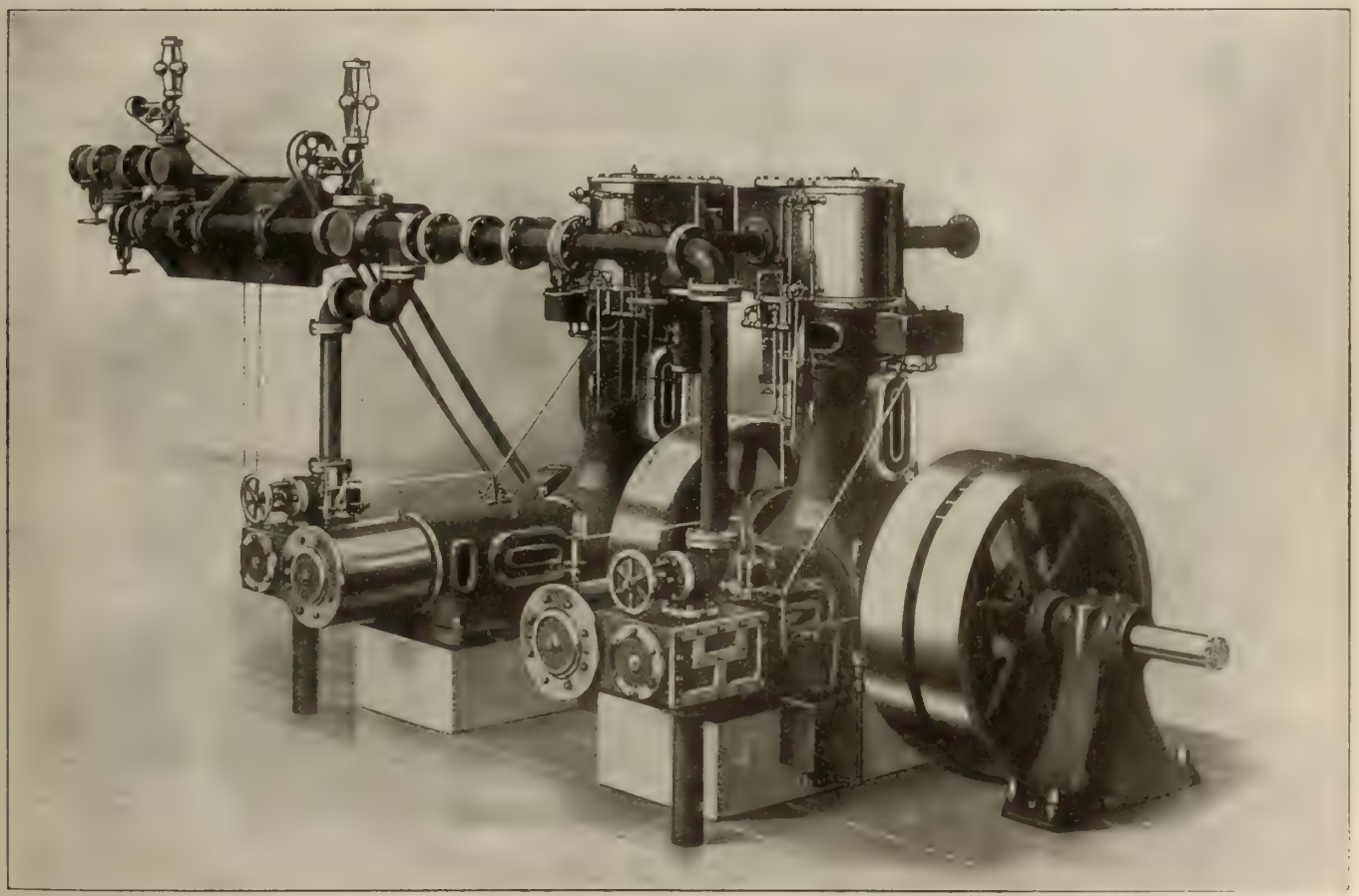


FIG. 1. AMERICAN-BALL FOUR CYLINDER VARIABLE SPEED PAPER MILL ENGINE

taken care of by heavy foundations and foundation bolts, and no serious trouble may occur; but since these forces increase as the square of the velocity of the reciprocating parts, a definite limit is soon reached, beyond which the speed of an improperly balanced engine cannot be increased.

lution, evenly distributed 45 deg. apart. A counter-weight on each crank transfers the horizontal reciprocating forces from a horizontal to a vertical plane, in which they meet equal and opposite reciprocating forces from the vertical reciprocating masses, which, therefore, neutralize unbalancing.

of power and other drawbacks of belt gearing between engine and shaft eliminated.

Speed Change Mechanism and Governors.

Figs. 3 and 4 show the speed changing and governing mechanism as used with American-ball paper mill engines. The devices illustrated perform a number of

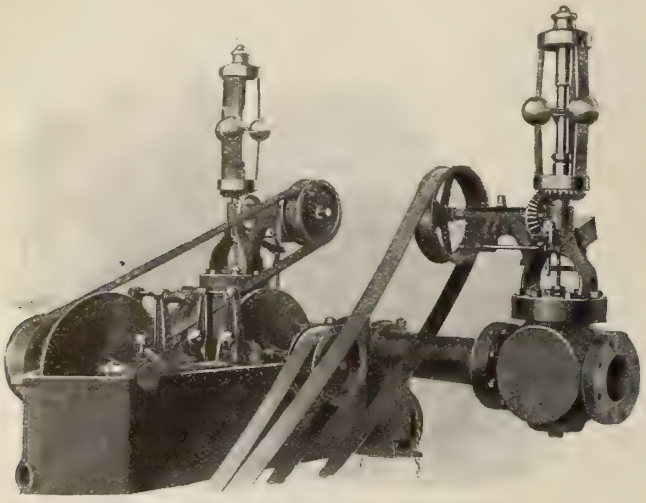


FIG. 3. SPEED CHANGING MECHANISM.

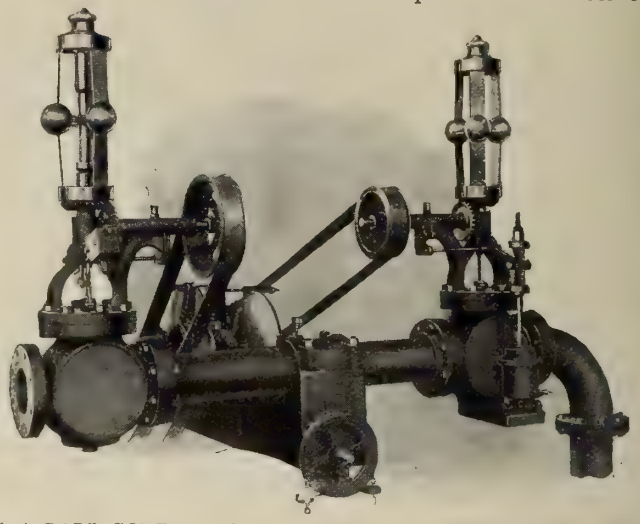


FIG. 4. BALL GOVERNING AND VARIABLE SPEED MECHANISM.

Four-Cylinder Paper Mill Engine.

The American-ball four-cylinder paper mill engine, shown in Figs. 1, 2, 3, 4, is designed with four cylinders, arranged in pairs at right angles. The engine is thus built of two units, each of which has a vertical and horizontal cylinder. Each pair of vertical and horizontal pistons drives a common crank pin, and there are eight power strokes per revo-

The balancing of this engine is claimed to be so perfect that it may be operated at speeds of 400 to 500 r.p.m. Furthermore, the engine may be operated at the low speed of 50 r.p.m. with good regulation, so that a total speed range of 8 to 1 and even 10 to 1 may be obtained. The engine may be coupled directly to the line shafting, and delays, complications, space requirements, loss

important functions, and, in fact, are a most important part of the whole engine equipment. Two governors are used, each being of a standard type, specially improved and adapted to the particular service. The first governor is the automatic engine safety stop, and is placed nearest the steam supply pipe, being shown at the right in Fig. 3.

As may be seen, this governor is

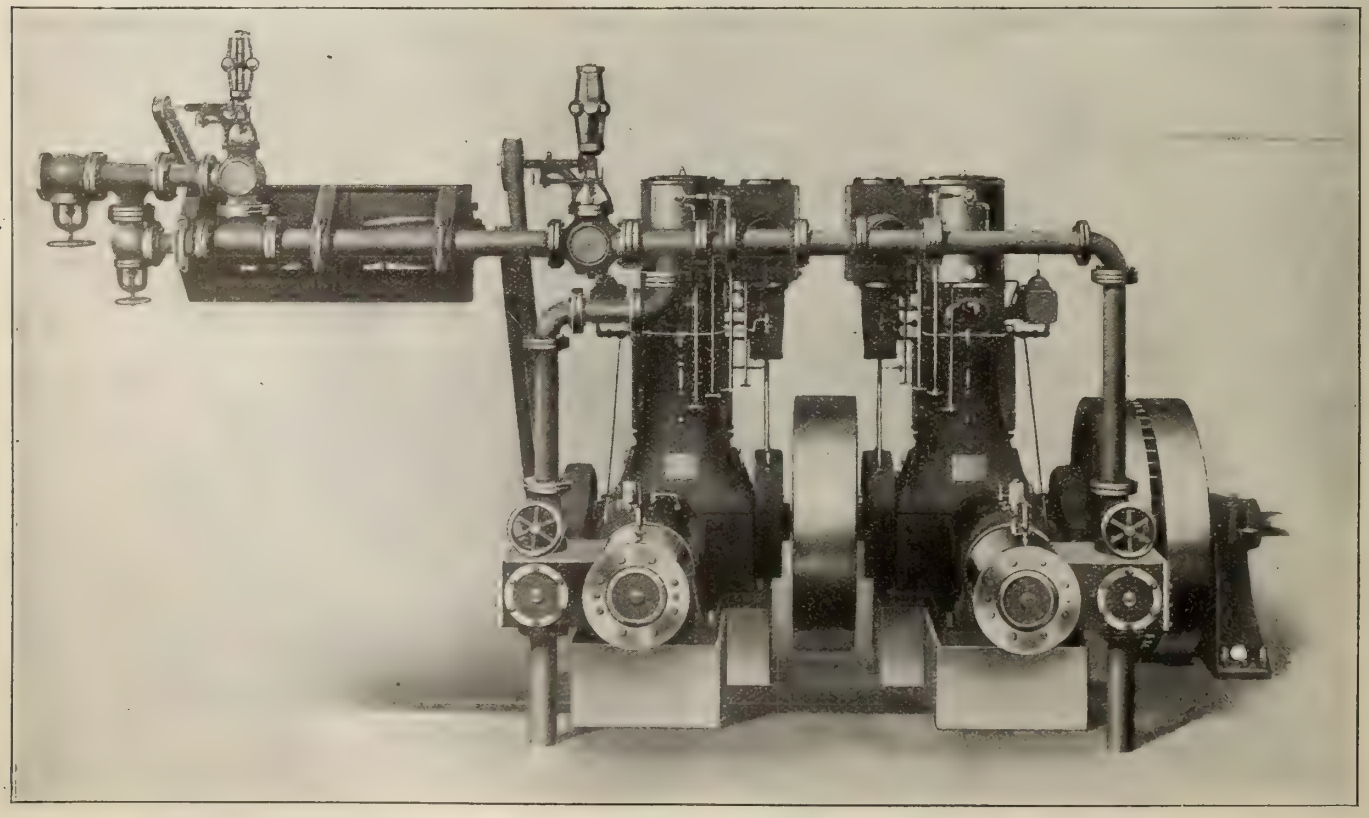


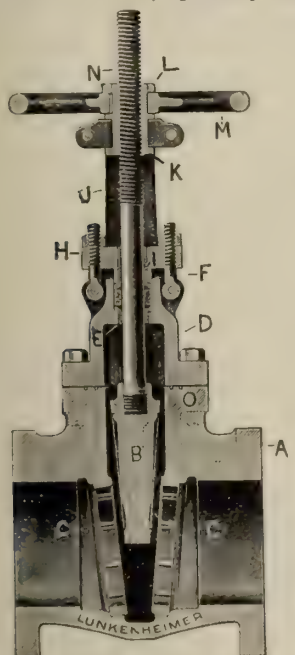
FIG. 2. ANOTHER VIEW OF THE AMERICAN-BALL FOUR CYLINDER PAPER MILL ENGINE.

driven by belt direct from the engine shaft and is fitted with an automatic tripping mechanism. The steam valve remains wide open throughout the whole normal range of speeds for which the engine is designed, but in case the speed exceeds the predetermined limit, the mechanism is tripped and the weighted lever closes the valve. At all normal speeds this governor valve has no throttling effect, hence it cannot affect the engine speed. The second governor, which may be seen to the left in Fig. 3 and to the right in Fig. 4, controls the engine speed, and is driven through the variable speed friction device, also shown.

Stabilizing Device.

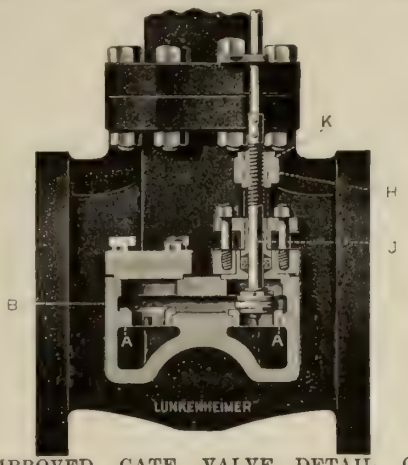
The requirement of constant speed is a most difficult one to meet. When once the speed of the engine has been adjusted to give a certain grade of paper, the speed must stay constant, and must not be affected by variations in steam pressure or back-pressure, either of which, with an ordinary governor, will cause surges in speed or hunting and breaking of the paper. To prevent such speed surges a standard governor has been equipped with a mechanism comprising stabilizing springs and an oil pot, which may be seen in the photographs. The piston of the oil pot receives motion from the governor stem through the spring stabilizing device, which absorbs shocks induced by sudden changes in speed of the governor balls.

This stabilized governor is driven from the engine through a variable speed friction device, specially designed,



IMPROVED GATE VALVE WITH OUTSIDE SCREW AND YOKE.

and which may be seen in Figs. 3 and 4. A belt from a pulley on the engine shaft drives a pulley on the friction device, which drives a second pulley through two discs and two pairs of friction wheels. Any speed from minimum to maximum may be imparted to the second pulley, which in turn drives the governor. The two large iron wheels or discs are each keyed to a pulley shaft. Bearing on the surface of these discs are four small friction wheels, one on each side of each disc. The driving disc keyed to the shaft of the driving pulley rotates the two friction wheels held



IMPROVED GATE VALVE—DETAIL OF BY-PASS.

against it by springs, and the second pair of friction wheels drives the second disc and the pulley keyed to its shaft. The speed is changed by simply shifting the position of the friction wheels, which are carried by four rockers located in pairs, each pair being held to a shaft which passes through guides, and may be shifted as desired by a chain wheel and lead screw cut at one end. Each pair of rockers is held together by springs, thus keeping the friction wheels firmly against the discs. All bearings are of the ball bearing type. A patent flexible coupling is fitted to each engine.

The American Engine Co., Bound Brook, N.J., are the manufacturers of the foregoing equipment.

AN IMPROVED GATE VALVE.

THE extensive use of the valve herewith illustrated has demonstrated that its durability and efficiency are fully appreciated by steam users. It can be had entirely of brass, of iron body brass mounted, of "puddled" semi-steel, or of cast steel.

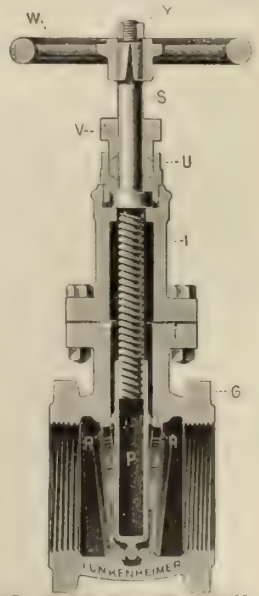
As seen by the illustrations, the valves are made in two forms—one with stationary stem and the other with outside screw and yoke. The seat rings, as well as the wedge disc, can be renewed when worn, thus making the valve as good as new. A desirable feature in the construction of the valves is the fact that when finishing the interior of the valve body, that portion which receives the seat rings is threaded to the correct angle of the tapers of the valve disc. The seat rings are threaded and faced off straight, and when screwed in place, they fit accurately to the tapers of the disc. This consequently makes it possible to easily renew the seat rings, should they become worn or broken.

The discs in both forms of valves are made entirely of bronze up to and including the 6-inch size on the medium, heavy and extra heavy patterns, and up to the 3½-inch size in the standard pattern. Above this they are made of iron with bronze face rings. As the valves are double seated, they will take pressure from either end. Either pattern of the gate valves can be packed under pressure when wide open. The stuffing box in the valve with stationary stem is made of bronze, and is tightly screwed into the hub.

The joint between the body and hub is worthy of attention, being practically indestructible. It consists of grooves cut in the top surface of the valve body, in which are placed seamless copper gaskets. The yokes and hubs are rigidly held to the body by large steel bolts, both the heads and nuts of which seat on spot-faced surfaces. The valve can also be had with exterior by-pass, a detailed view of which is shown.

The by-pass used is not separate from the valve proper, but is cast integral with the body, as will be seen by the illustration, and this method has many points of excellence. The additional metal required for the by-pass tends to strengthen the valve body, and, being self-contained, it is not affected by extremes of expansion and contraction.

The Lunkenheimer Company, of Cincinnati, Ohio, are the manufacturers of



IMPROVED GATE VALVE WITH STATIONARY STEM.

this valve, and the patentees of the improved form of by-pass used. They have given the valve the trade name of "Victor."

POWER PLANT DEVELOPMENTS

A record of current municipal, manufacturing and general industrial projects, involving steam, gas, oil, electricity, air and water power equipment requirements.

Electrical

Hull, Que.—City Engineer Laforest will install larger electrical machinery in the city pumphouse.

Sarnia, Ont.—The Mackenzie Electric Company have completed the new refrigerating plant for the F. Kaupp meat market.

Stambridge East, Que.—The Board of Trade will ask the municipal council to pay for installing electric street lights in the village.

Stratford, Ont.—Lighting and general equipment is to be purchased for the new extension to Sebringville. Superintendent, R. H. Myers, electrical department.

Millwood, Man.—The power house of the old Cartwright flour mill was swept away from its foundations when the Assiniboine River flooded, April 23.

London, Ont.—The London Electric Co. will shortly install new turbine machinery and will declare electric war on the Hydro-Electric Commission. It is reported that they will reduce their rates.

Windsor Mills, Que.—It is reported that farmers in the vicinity of Hardwood Hill are trying to form a telephone company, for the purpose of connecting Hardwood Hill with Windsor.

Johnville, Que.—Another telephone company is expected here in the near future. The Eastern Township Telephone Co. have already a number of contracts signed and expect to build a party line from here to Martinville at once.

Toronto, Ont.—The City Hydro-Electric Commission and the works department have reached a settlement of the disputed account for power at the waterworks. This was for $94,000, and the Commission has agreed to reduce it by one-third.

Sydney, N.S.—The Maritime Coal, Railway & Power Co. will make large extensions to the power plant at Chignecto, N.S., and will electrify the colliery plant at Joggins Mines, to meet the increased demand for coal and electric power.

Govan, Sask.—The electric light plant was put in operation for the first time on Tuesday, April 15th. The equipment consists of a 20 H.P. Fairbanks engine and a dynamo capable of lighting 500 lamps. The work was done by Messrs. Henry and Sutherland.

Edmonton, Alta.—Ten miles of electric street railway lines in all will be built in Edmonton this year. They will be built by private interests, but the tracks, poles and wiring are to be turned over in two years. The cost will be between $150,000 and $200,000.

Vancouver, B.C.—Mackenzie & Mann, closely connected with the Canadian Northern Railway, are figuring on extensive hydro-electric developments along the Fraser River in British Columbia. For some time past, they have been active in securing water rights.

New Westminster, B.C.—The C.P.R. have fixed their first division point to the North-west at Boston Bar, and are

CANADIAN BOVING CO. PLANT AT LINDSAY, ONT.

The Canadian Boving Co., hydraulic engineers, 164 Bay St., Toronto, have purchased the factory of the Madison-Williams Co., Lindsay also twelve acres of land adjoining same, on which they will build extensions to treble the size of the present plant. They will do this on condition that the ratepayers of Lindsay furnish a cash bonus of $10,000 to assist in the additional property purchase and that the property will be exempt from all municipal taxation, but not from school or local improvement taxes. The agreement with the town calls for the employment, if these conditions are fulfilled, of not less than sixty men, but Mr. Clayton, manager of the Canadian Boving Co., states that 150 men will be employed as soon as this matter which was submitted to the electorate quite recently, has been settled. The new owners will be in the market for new machine tool equipment.

At their new plant the Canadian Boving Co. will manufacture turbine water wheels, pumps, pulp and paper machinery, in fact they will manufacture in this plant ultimately all the machinery required for their business in Canada. The Madison-Williams plant as it exists at present is not large enough.

The parent factory of the Canadian Boving Co. is at Carlstadt, Sweden, where they commenced business in 1873, on papermaking machines and turbine water wheels. In this plant they employ about 800 men. They have now a capital of $650,000, and are well known as an enterprising and up-to-date firm, both here and in Europe. They have also plants in England and in Germany. One hundred thousand dollars will be spent on improvements at the Lindsay plant.

making provision for supplying light, water and power to the place. A generating station will be built and 500 H.P. developed for use in shops and terminals and for lighting the town.

Montreal, Que.—Alex. McArthur & Co., Ltd., paper makers, are going to erect a new plant here, the railway having bought the site of their present place. They will be in the market shortly for two 125-h.p. boilers and other equipment, including that for a small machine shop. This company is also going to install a new power plant at their place in Joliette.

Sydney, N.S.—The Cape Breton Electric Company is shortly to erect a power station at Reserve Junction, N.S., in which will be installed a powerful generator to furnish the necessary power for the Sydney and Reserve ends of the tram service. As soon as this large plant is installed, the smaller plant in commission at Dominion for the last four years will be dismantled.

Le Pas, Man.—Several firms are now tendering on the contract to erect the wireless station to be built here at an early date in connection with the construction of the Hudson Bay Railway. A. E. Reoch, secretary-treasurer and chief engineer of the Canadian Marconi Telegraph Co., of Toronto, and Walter A. Rash, of the radio telegraph branch of the department of naval service, Ottawa, were recently here.

Montreal, Que.—At the annual meeting of the Maritime Coal, Railway and Power Company, Limited, held in Montreal, the president reported that the negotiations for the sale of a considerable block of the company's securities had been successful, and it was contemplated to carry out during the ensuing year large extensions to the power plant at Chignecto, and electrification of the colliery plant at Joggins' Mines, to cope with increasing demand for coal and electric power.

South Vancouver.—The British Columbia Electric Railway Co. will erect a new $90,000 sub-station in South Vancouver to be built of reinforced concrete, with a gallery for the switching apparatus. The equipment will include three motor generator sets of 1,000 kilowatts capacity each and a transforming equipment of 7,000 kilowatts capacity. The railway company has also promised to make considerable extensions to its trackage if the municipality agrees with its conditions.

North Bay, Ont.—A new organization known as the United Board of Trade of New Ontario, has been organized at Sudbury, to include the Boards of Trade of Sudbury, Sault Ste. Marie, North Bay, Sturgeon Falls, Callender, Blind River, and Thessalon. One of the first matters taken up by the new organization was the question of interesting the Ontario Hydro-Electric Commission in developing the water powers of the north, and the meeting endorsed a proposal to hold a conference with the commission on the subject at an early date.

Toronto, Ont.—It is understood from press reports that interests connected with the Canadian Northern Railway Co. have acquired $400,000 of the bonds of the Chatham, Wallaceburg and Lake Erie Radial Railway, which gives them control of that road. Its equipment includes three electric locomotives and seven double track passenger cars, as well as about 20 freight cars. One of the locomotives is rated at 400 horsepower, and is capable of hauling a train of 25 cars. Each of the other locomotives is 200 horse-power. The company's power house, where energy is generated by steam, has now been taken over by the Chatham Gas Co.

Regina, Sask.—The following contracts were passed by the Fire, Heat and Light Committee for approval of the council: Weather-proof Copper Wire—Northern Electric Company, 50,000 lbs.; H. W. Laird Co., 52,000 lbs.; Canadian Wire Cable Co., 25,000 lbs.; Deering Electric Co., 25,000 lbs. Cedar Poles—C. W. Bacon, 1,510 poles, $11,949. Cross Arms—Dawson & Co., 3,400 cross arms, $1,073. Pins, Insulators, etc.—Dawson & Co.—$2,565.45. Pole Line Hardware—Northern Electric Co., $2,484.05. Transformers—Canadian General Electric Co., $9,089. Meters—Chamberlain Hookham Meter Co., $13,100. Chapman & Walker, $7,490. Street Lighting Equipment—Three lighting equipments complete, Canadian Westinghouse Co., $15,452. Series Cutout Mast Arms—Mainer Electric Co., $2,325.75. Underground Material—Imperial Wire and Cable Co., $549. H. W. Johns, Manville Co., $664.58. Fire Alarm Equipment—Northern Electric Co., $2,433. Mainer Electric Co., $336.

Municipal

Sydney, N.S.—The city is considering the construction of an incinerator.

Stafford, Ont.—The ratepayers on April 21 agreed to spend $11,546 on sewers.

New Westminster, B.C.—The city is borrowing $200,000 for extensions to waterworks.

Brandon, Man.—The city will construct 44,155 feet of sewers, costing $104,155.

St. Thomas, Ont.—The city will spend $100,000 on an extension to its waterworks system.

Weston, Ont.—The town is borrowing $40,000 to be spent on a sewage system and disposal plant.

London, Ont.—Engineer Chipman's report on the storm sewer survey shows that the cost will be $392,000.

Wingham, Ont.—A by-law to raise $6,500 to purchase road making machinery will shortly be submitted to the burgesses.

Woodstock, Ont.—The Water and Light Commission will raise $12,000 for new works, including renovation of mains.

Cochrane, Ont.—A sewage extension to cost $3,000 will be built. Engineer-in-charge, Suttcliffe & Neylands, New Liskeard, Ont.

Prince Albert, Sask.—Fire apparatus to cost $30,000 will be purchased by the city council. Clerk, C. O. Davidson. Fire Chief, Ald. G. Wagner.

Fernie, B.C.—Recently the burgesses voted in favor of the by-law to raise $10,000 for the purpose of extending the electric light system of the city.

Toronto, Ont.—Following the recent trouble with the water supply, Works Commissioner Harris has estimated the cost of another 4-ft. pipe across the bay at $300,000.

Port Coquitlam, B.C.—An 18-foot paved road from Vancouver to Pitt River is proposed at a cost of $30,000 a mile. Port Moody, Burnaby and Coquitlam will be on the route.

New Westminster, B.C.—City Engineer Blackman has completed plans for No. 1 and No. 2 sections of the Sapperton sewerage scheme. Burnaby has agreed to pay $150,000 of the cost.

Stratford, Ont.—The Council have passed a by-law providing for the construction of a trunk sewer across the southern portion of the city, tapping the Erie Street sewer, at an estimated cost of $11,546.70.

Berlin, Ont.—The city council on April 14 paseed a by-law authorizing the construction of a new trunk sewer, which it is estimated will cost in the neighborhood of $70,000. It will be a 48-inch main, and according to estimates will supply the needs of the city until 70,000 population is reached.

Waterworks

Cochrane, Ont.—A watermain extension to cost $6,500, is planned by the

town council. Engineer in charge, Suttcliffe & Neylands, New Liskeard, Ont.

Courtney, B.C. — Applications for licenses to take water from unnamed creeks in the Courtney district for municipal purposes are made by the Courtenay Waterworks Company. A storage reservoir of ten million gallons is proposed for conservation purposes.

New Hamburg, Ont.—Waterworks, to cost $25,000, are planned. Three miles of pipe 10 in., 9 in., and 6 in., water tower of concrete, capacity 50,000 gals., 90 ft. high, turbine pump, electric motor, covered concrete reservoir, hydrants, meters, valves required. Town clerk, J. F. Katzenmuir.

Quebec, Que.—The work on the laying of a new 40-inch main from Corette to Quebec is being resumed. The work should be completed by December. Mr. Connolly who is superintending the work has purchased a new jointing machine and will probably buy another operating by compressed air.

Park Hill, Ont.—The contractors have the foundation for the new waterworks tower excavated. The foundation is 4½ feet deep, 6 ft. wide. The diameter from outside to outside is 29 ft. 4 inches. The tower is 107 ft., 4 inches high from bottom of base to top of dome. The tank on top of the tower will be 27 ft. in diameter inside and 29 ft. high, holding 100,000 gallons of water.

Collingwood, Ont.—Chairman Caslake of the Water and Light Commission recently informed the town council that the mountain water scheme would cost, including sand filter, pumps, pipes, laying of pipes, etc., $150,000, or with heavy standard pipes throughout, $223,150. A plan has also been prepared by Chipman & Power, engineers, Toronto, for extending the water system at a cost of $75,000. No decision has yet been come to.

Testing Cast Iron Pipe.—Refusal by Messrs. Crane & Co., contractors for the supply of a large order of water pipe to Vancouver, to sign the contract if tests of fitness had to be applied in Vancouver, led to a discussion at the civic water committee as to whether the pipes should be tested locally or at Pittsburg to ensure compliance with the specifications, the result being that the question was placed in the hands of the city engineer and purchasing agent to deal with. The opinion of the committee was that the pipe should be refused if it did not come up to specifications.

Contracts Awarded

Fort William, Ont. — The city have awarded a contract for a 500 K.W. generator costing $11,000, to the Can. General Electric Co.

Montreal, Que.—With the approval of the Electric Service Commission, the Board of Control will accept the tender of G. M. Gest, contractor, Montreal, for the construction of the underground conduits along St. Catherine Street, from Papineau Avenue to Guy Street. The contract price of the work is $217,000, and, the time specified is six months.

Trade Gossip

The General Manufacturers' Agencies, Ltd., Montreal and Toronto, is now handling the line of steam, water and air specialties in Eastern Canada for Kieley & Mueller, New York City.

The Mead Electric Co., formerly located on St. George Street, Montreal, have been compelled by the rapid growth of their business to remove to more commodious premises in the Unity Building. The business consists chiefly of repair work, such as rewinding dynamos, correcting electrical troubles, etc., and the field hitherto covered has extended from Rimouski to Winnipeg. With the increased space and facilities now at his command, Mr. Mead hopes to extend his operations from ocean to ocean.

The Smart-Turner Machine Co., Ltd., Hamilton, Ont., have recently secured the following orders:—Mr. JJ. Morley Young, Waterford, Ont., Rotary Pump; The Dominion Vinegar Works, Hamilton, Ont., Centrifugal Pump; The Central Prison Farm, Guelph, Ont., Automatic Feed Pump and Receiver; The Hoards Cheese Co., Hoards, Ont., Duplex Pump; The Buffalo Ontario Refining & Smelting Co., Kingston, Ont., Triplex Power Pumps; The Cloverdale Creamery, Hamilton, Ont., Centrifugal Pumps; The Canadian Warren Axe & Tool Co., St. Catharines, Ont., Rotary Force Pump.

The Electrical Maintenance and Repairs Co., 162 Adelaide St. West, Toronto, have found business increasing so rapidly, that they have removed into larger premises. Until recently, they occupied only the upper floors of the above address, now they have taken the ground floor, and have converted it into an up-to-date electrical repair shop. The machine tool equipment, which was upstairs, has been transferred to the ground floor and re-arranged, so as to allow of no loss of time in the handling of work. An overhead carrying system, designed by W. D. Beath & Sons, Toronto, has been installed for carrying armatures and parts of motors to the benches and lathes, also to the baking oven and impregnating tank. This arrangement eliminates a great deal of unnecessary handling. The firm conducts a general construction and repair business. They have recently arranged with a European firm of manufacturers for a line of motors, general supplies and lamps. These will be carried on the upstairs floor, and in a week or so the firm will be supplying full lines of electrical equipment. The second floor which was formerly the machine shop, has been transformed into offices and storerooms.

Personal

Geo. T. Clark, of Saskatoon, Sask., will continue in the capacity of city engineer.

Geo. Smith, engineer, of Lindsay, Ont., has been appointed town engineer of Midland, Ont.

City Engineer J. H. Kilmer has moved his family and effects from Vancouver and intends making Port Coquitlam his permanent residence.

H. C. Barber, formerly of the Hamilton and Toronto Hydro-Electric departments, will, it is said, be engaged by the Cataract Power Co.

J. C. Nash has been appointed assistant engineer to Engineer Sifton of the Hydro-Electric system. He was recently employed by the Westinghouse Co.

W. A. Ostrom has returned to the employ of the Canadian General Electric Co. as superintendent of construction in the West. Recently he has been chief electrician for Saskatoon, Sask.

J. G. Mill is resigning from the city engineer's department, Toronto, and has been awarded the contract at Brighton, Ont., for the waterworks installation. The town will expend $50,000 on same.

T. P. Marshall, the retiring superintendent of stations of the Toronto Electric Light Co., was waited on at his home, 225 Booth Avenue, a few weeks ago, by a deputation from the operating department, who presented Mr. and Mrs. Marshall with a beautiful leather couch.

Gerald H. Moore has been appointed resident engineer of the Canadian British Engineering Co., Ltd., with offices at 324 Smith Street, Winnipeg. Mr. Moore is a son of the late Col. Moore, who was for some years head of the Mounted Police in the Winnipeg district. He was educated at South Kensington, London, England, and served his time with the Davey Paxman Co., of Colchester, England.

W. R. Sweaney, until recently acting general manager of the Toronto Hydro-

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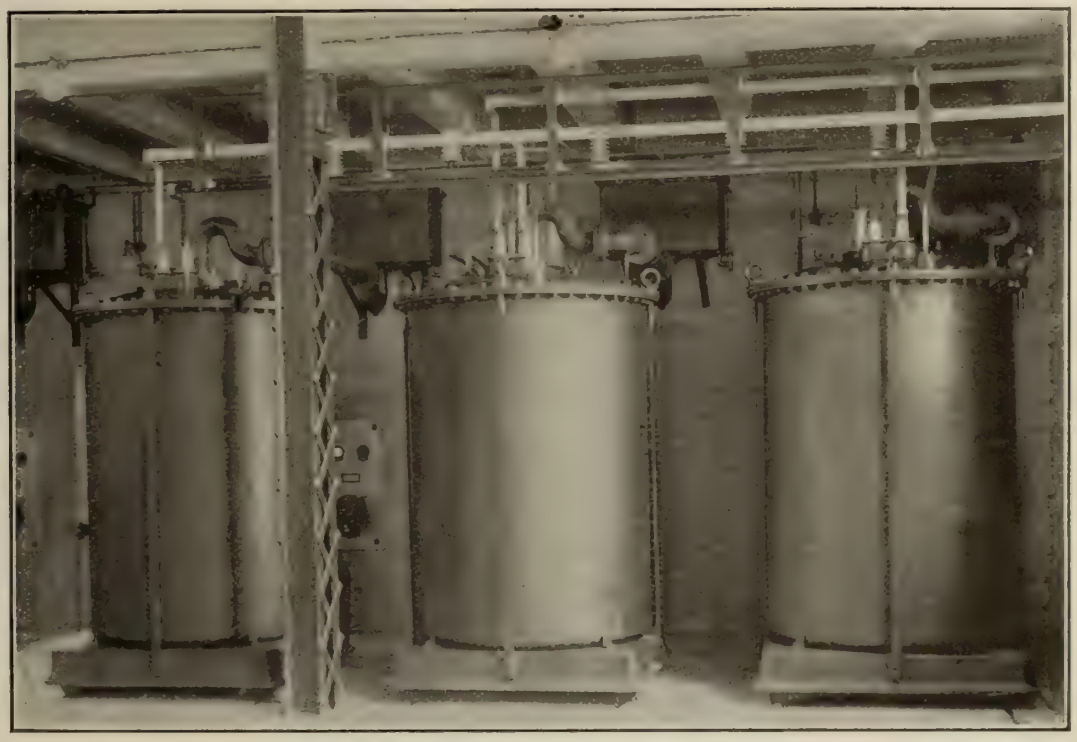

THREE OF SEVEN 750 K.V.A. 22,000 VOLT, SINGLE PHASE, OIL INSULATED WATER COOLED TRANSFORMERS, SUPPLIED AND INSTALLED FOR THE CITY OF PORT ARTHUR.

Four of the above were a repeat order after the first bank had been in successful operation for eighteen months.

We also supplied the whole of the switching apparatus, lightning arresters and two 750 h.p. motor generator sets.

Attention is especially drawn to the expansion vessels connected by a pipe to the top of the transformer case. Our transformers are completely filled with oil including this connecting pipe, and part of the expansion vessel, expansion and contraction of the oil taking place in the latter.

By means of the peculiar shape of the connecting pipe the hot oil by the time it rises to the expansion vessel is sufficiently cool so that no hot oil comes in contact with the air, and no moisture can enter the transformer itself. This arrangement also keeps the oil in perfect condition and prolongs the life of the transformer.

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HEAD OFFICE:

Transportation Building - MONTREAL

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STANDARD BANK BUILDING
TORONTO

McARTHUR BUILDING
WINNIPEG

Electric commission, has been engaged by the Toronto Electric Light Co. The appointment was made a few days ago by General Manager Fleming of the Toronto Railway and Electric Light systems. Mr Sweaney will be sales manager, and succeeds Parker Kemble, who recently went Cincinnati.

H. A. Harrison, who has been connected with the Toronto sales staff of the Canadian Fairbanks-Morse Co. for a number of years has quite recently joined the Bawden Machine & Tool Co. taking charge of the sales work for this company. Mr. Harrison will give his attention particularly to the pump department, looking after the sales of the Bawden steam pump which has quite recently been placed on the market.

H. H. Couzens, general manager and electrical engineer of the Corporation of Hampstead, London, England, has been appointed general manager of the Toronto Hydro-Electric system. Mr. Couzens has had a wide experience in construction work, in the complete installation of electrical plants, having held important positions with the Corporations of Taunton, Bristol, West Ham and Hampstead. He is due here in a few weeks.

R. A. Ross, acting manager of the Toronto Hydro-Electric System, has made the following appointments on the Hydro staff:—Percy E .Hart, as electrical engineer; J. Orr, general superintendent; George Stevenson, general inspector; Geo. Schwanger, as engineer of distribution; J. M. McNeilly, superintendent of meter department; R. J. Lee, contract agent; J. B. Kitchen, engineer of operation department, and G. Devlin, as head salesman.

Catalogues

"**How to make your canvas belts do best work**" is the title of a 12-page booklet published by the Cling-Surface Co., Buffalo, N.Y. The booklet is well illustrated and is full of good sound technical arguments and data that should appeal to belt men.

The Lunkenheimer Co., Cincinnati, Ohio, have favored us with a number of booklets dealing with valves, cocks, etc Each one is a complete treatise on the subject dealt with. For instance, one deals with the regrinding of valves, and contains full directions how to accomplish this, for every variety of valve. besides being illustrated with drawings. Other booklets deal with water gauges, water columns, oil cups, safety valves, reseaters for regrinding valves, oil pumps, whistles, cylinder cocks, cylinder lubricators, grease cups, etc. Engineers are invited to send for the complete set.

Book Reviews

"**Saw Filing and Management of Saws,**" by Robt. Grimshaw: The Norman W. Henley Publishing Co., New York, price $1.00. This book has now run to the third edition. It is a practical treatise on filing, gumming, swaging, hammering and brazing band saws. It tells which files to use, and gives useful hints for repairing and caring for saws. In this edition the author has included original "wrinkles" which have developed during the many years' experience in the use of saws.

"**Alternating Current Machinery,**" by William Esty, S.B., M.A., head of the department of electrical machinery, Lehigh University: The American School of Correspondence, Chicago. Price $3.00. This book has been prepared, the autthor says, with the object of giving the beginner and the so-called practical electrician a working knowledge of alternating current apparatus, in order that he may know how to install and operate it intelligently. Attention is early called to the characteristics of alternating-current problems which cause them to differ from direct current problems. The work is elementary, and the author expresses the hope that the reader will follow it up with study in more advanced text books.

"**House Wiring,**" by Thomas W. Poppe, electrical engineer and contractor: The Norman W. Henley Publishing Co., New York. Price 50c. This is a treatise describing and illustrating up-to-date methods for installing electric light wiring. It is intended for an electrician, helper and apprentice. It aids in solving all wiring problems, and contains nothing that conflicts with the rulings of the National Board of Fire Underwriters. Only practical examples of work are mentioned in this book. The author has treated the subject in a clear, non-technical manner, easily to be understood.

"**Brazing and Soldering,**" by James F. Hobart. Fifth edition, revised and enlarged; illustrated; paper covers, 25 cents. The Norman W. Henley Publishing Co., New York. The terms "brazing" and "soldering" are explained in the author's opening words, and excellent devices for brazing under various conditions are described by him. The first twenty pages are devoted to brazing, and the remainder to soldering. Splendid illustrations of the implements used, and the construction of brazing and soldering furnaces are given.

"**An Investigation of Explosion-Proof Motors,**" by H. H. Clark, has been issued by the United States Bureau

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If you have been experimenting with other types of cleaners which have failed to make good, do not put the **Liberty** in the same class, but let us send you one on trial, to prove their superiority and show you what a **real Cleaner** can do.

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to protect every plant that draws its water supply from lakes, ponds or rivers.

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Those who wish to sell or buy a business, obtain competent help, connect with satisfactory positions or secure aid in starting new enterprises, should not fail to use the Want Ad. Page of The Power House.

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LIBERAL COMMISSIONS TO DEALERS AND others handling Vulcan Soot Cleaners; applied to all types of boilers. Vulcan Tube Cleaning Systems, Limited, 42 Craig St. West, Montreal. (4tf)

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LAKE ERIE BOILER COMPOUND CO. REquire a few first-class representatives to sell their well-known compound. Liberal commission paid to live men, and exclusive territory. Write at once, giving references, 11 Colborne St., Toronto. (tf)

WANTED — EVERY POWER HOUSE IN Canada to remember that C. E. Shedrick, Craig Street West, Montreal, is still repairing measuring instruments, both switchboard and portable. Twenty-five years' experience in repairing all kinds and makes on the market. Integrating meters repaired, tested and sealed, and returned on quick time.

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WANTED—CANADIAN REPRESENTATIVE to distribute ice making and refrigerating machinery, internal combustion engines of all kinds, and special machinery of any kind built to order. Cleveland Ice Machine & Mfg. Co., Lorain, Ohio, U.S.A.

MISCELLANEOUS

BECAUSE THE REMINGTON TYPEWRITer Company's Employment Department has earned the reputation among stenographers of filling the most desirable office positions, the result is that we place the most desirable class of office help. May we fill your stenographic vacancy? No fees. 144 Bay St., Toronto.

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of Mines, as Bulletin No. 46. A motor enclosed by a casing so that an explosion of mine gas and air within the casing will not ignite a mixture of the same gas outside the casing, is considered by the Bureau of Mines to be "explosion-proof." Mr. Clark tells in this bulletin how such a motor is constructed. He describes devices for reducing below the ignition point of gas (methane) the temperature of any flames that may be discharged from the motor casing. The investigation described in this bulletin was undertaken by the Bureau of Mines for the purpose of ascertaining methods of lessening the risks attending the use of electricity in mines. Various makes of motors were tested, no two being protected in the same manner. The bulletin is illustrated with photographs and drawings.

New Incorporations

The Vilter Mfg. Co., incorporated at Toronto, to manufacture steam engines and all kinds of machinery. Capital, $40,000.

Sangamo Electric Co., of Canada, Ltd., incorporated at Ottawa, to do business in Montreal. Capital, $50,000. Incorporators—L. MacFarlane, Charles A. Pope, G. Barclay, Wm, B. Scott, and J. G. Cartwright, all of Montreal, Que.

The Electric Repair & Contracting Co., Ltd., incorporated at Ottawa, with a capital of $50,000, to manufacture electrical goods. Incorporators: George Matthews, of Westmount, Robert Urquhart, Ulric A. Leduc, Ralph F. Stockwell, Edson G. Place, of Montreal.

The Metropolitan Engineering Co., of Canada, Ltd., incorporated at Toronto, to manufacture electrical apparatus; incorporators:—Joseph S. Lundy, Charles G. O'Connor, Jean McGillicuddy, Alice Dwyer, all of Toronto; Mabel Anderson, of Streetsville.

Canadian Allis-Chalmers, Ltd., incorporated at Ottawa, to take over the business of the Allis-Chalmers-Bullock Co. Capital, $500,000. Incorporators—B. Haddy, Wm. H. Nesbitt, G. Logan, J. Murrode, J. A. Bremner, A. E. Guest and Wm. McKennedy, all of Toronto, Ont.

American Light, Heat and Power Co., of Canada, Ltd., incorporated at Ottawa to manufacture and sell light, heat and power plants. Capital, $150,000. Incorporators—Chas. Bruchesi, J. A. Marion, A. P. Raymond, A. Labelle and H. Bienvenue, all of Montreal, Que.

Dietrich, Ltd., incorporated at Ottawa to manufacture and deal in all kinds of electrical appliances. Capital, $50,000. Incorporators—W. N. Dietrich, G. E. Templeman, E. R. Hughes, all of Montreal West, Que, and R. F. Stockwell and E. G. Place, both of Montreal, Que.

St. John, N.B.—The Oil Motor and Manufacturing Co. has been formed, and will make oil engines in this city. The new concern, which will operate the Myers Machine Shop for a while, is capitalized at $150,000. New machinery will be purchased. The directors have elected Dr. E. J. Broderick president, and Mr. A. E. Massie, treasurer.

Lewis Lukes, formerly vice-president and general manager of the Monterey Railway, L. & P. Co., one of the Mackenzie and Mann group, has been appointed assistant to the President of the Canadian Northern Railway, with headquarters at Toronto.

During eleven months, April 1, 1912, to March 1, 1913, 357,331 immigrants arrived in Canada, consisting of 133,711 British, 124,398 from the United States, and 99,222 from other countries.

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Lubricating Oils and Greases
Belting—all descriptions
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NEAREST SHIPPERS TO QUEBEC DISTRICT
Prompt Attentian and Immediate Delivery.
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¶Fifty per cent. of the Power Plants in Canada are losing money through their Boilers and Steam Pipes being poorly insulated.

NOTHING PAYS SO WELL AS GOOD INSULATION

¶KIESELGUHR PIPE AND BOILER COVERING for High Pressure work is SUPERIOR to anything in this line. You will MAKE MONEY by using it besides increasing the efficiency of your Power Plant.

¶We are prepared to tender on any sized Contract and will guarantee satisfaction.

¶A great number of the largest factories and power plants in the United States are insulated with this the Newest and Best Covering.

Write for circular giving full information.

Kieselguhr Company of Canada, Ltd.

520 Traders Bank Building, Toronto, Canada

MONCRIEFF'S "UNIFIC" WATER GAUGE GLASSES

Stand in a Class by Themselves for Quality, Efficiency and Economy
A trial will convince you. Write for Catalog.

W.J.WALL, 136-134 BLEURY ST. MONTREAL.
(CANADIAN REPRESENTATIVE)

QUIT TAKING CHANCES ON YOUR ELECTRICAL REPAIRS

Look over your shop and send us that old MOTOR or DYNAMO that needs winding or repairing.

Tell us your electrical troubles. We fix anything — anywhere.

We do work from Rimouski to Winnipeg.

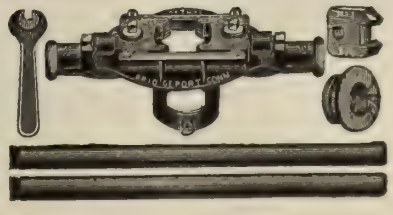
To-day is the day to write. Promptness our motto.

Absolute guarantee of satisfaction or money back.

What more do you want?

See us in our fine new premises.

MEAD ELECTRIC CO., LIMITED
Unity Building Montreal, Que.



GENUINE ARMSTRONG STOCKS AND DIES FOR CUTTING PIPE & BOLTS ARE THE BEST.

PIPE MACHINES
PIPE CUTTERS
HINGED PIPE VISES
RATCHET ATTACHMENTS

Manufactured by

THE ARMSTRONG MFG. CO.
298 Knowlton St.
BRIDGEPORT, CONN.
NEW YORK CHICAGO
Catalog mailed on request

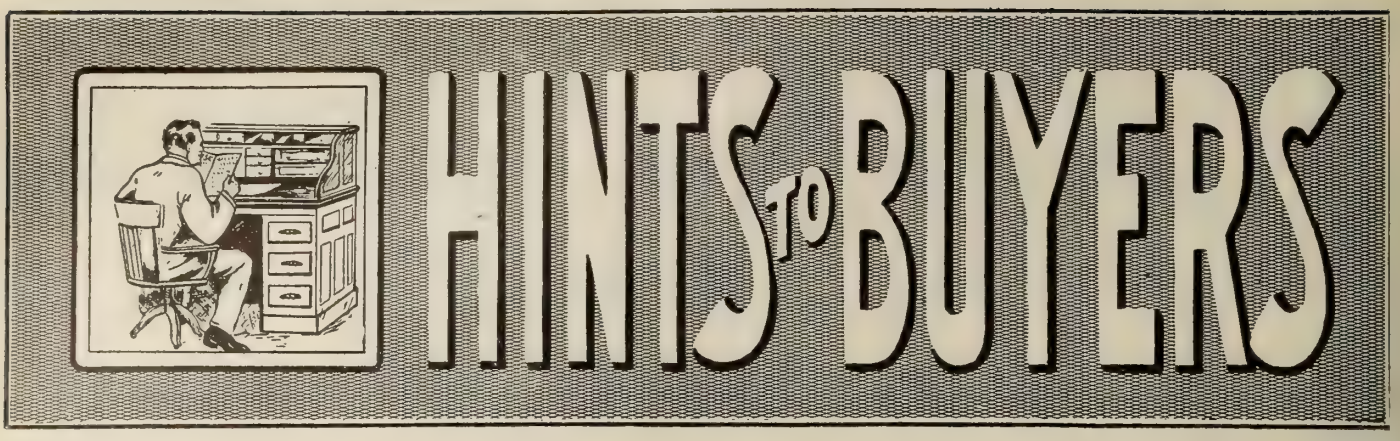
A STRAIGHT TIP

Every engineer knows that **Dixon's Flake Graphite** will cure a hot bearing, and restore a cut or scored bearing or cylinder to its original condition. Then why not use a little

Dixon's Flake Graphite

Continuously in your oil or grease, in order to maintain the bearing surfaces so perfectly smooth and true that friction and abrasion and wear cannot exist there? We will be glad to tell you how to use graphite if you are interested in saving money in your plant. Write for a free sample and our book "Graphite As a Lubricant," No. 222.

JOSEPH DIXON CRUCIBLE CO.
ESTABLISHED 1827
JERSEY CITY, NEW JERSEY



ALLIGATOR BELT LACING

FLEXIBLE STEEL

Makes Joints Quickly.

Only a Hammer Required.

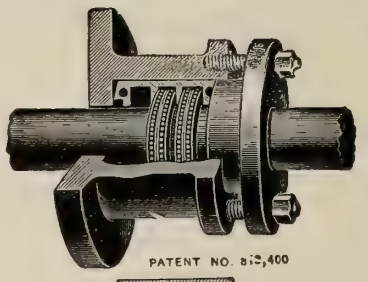
No Holes to Punch.

Forms the Strongest Part of The BELT.

Let Us Send One On Trial.

The Crescent Oil Company, Hamilton and Toronto, Ont

Stocks carried by—Sadler & Haworth, Montreal; Austen Bros., Halifax; P. A. Gouin, Three Rivers, P.Q.; J. S. Mitchell & Co., Sherbrooke, P.Q.; Great West Engine Packing Co., Winnipeg; F. H. Andrews & Son, Quebec, P.Q.; E. N. Jones, St. John, N.B.



PATENT NO. 8[illegible]2,400

PAT. NO. 436,177 " " 500,699 " " 534,104 " " 602,328

PAT. NO. 854,541 " " 854,542 " " 725,888

Why not Buy the Best, when in market for Packing?

HOLMES'

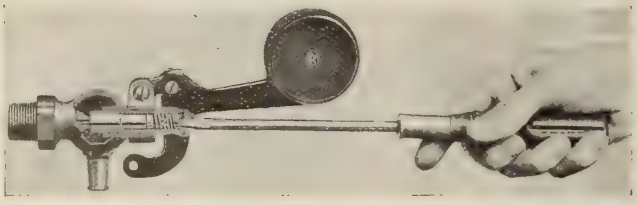
Metallic Packing

is Guaranteed 3 years

Lasts many times longer. 30 days trial. Less oil. No cutting. Easily applied to any Steam Engine, Air Compressor or Gas Engine. Satisfaction or no pay. Write us.

Holmes Metallic Packing Co., Wilkes-Barre, Pa.

OHIO GAUGE COCK



A simple twist of the wrist with a screw-driver instantly grinds the babbitt disc (1) to a **tight seat.** No other Cock possesses this popular feature.

If your dealer cannot supply you, we will ship direct. Write for Catalog K-C.

THE OHIO BRASS CO., Mansfield, O.

Notice to Stationary Engineers

Everyone operating a Stationary Steam Plant of 50 h.p. or over, in the Province of Ontario, must hold a Certificate from this Board. Anyone operating such a plant without a Certificate is liable to the penalties set forth in the Stationary Engineers' Act

HON. J. S. DUFF,
Minister of Agriculture.

W. C. McGHIE,
Chairman of Board,
Parliament Buildings, Toronto

Mueller Pressure Reducing and Regulating Valves

Give accurate and absolute control of pressures of water, steam, air, gas, oil, carbonic and acetylene gases—in fact, all kinds of pressures. Their efficiency is firmly established. Manufactured under Canadian patent No. 127,566. Address:

DOHERTY MFG. CO., Limited
Sarnia - Ontario

Manufacturer for The H. MUELLER MFG. CO., Decatur, Ill., and New York City.

EVERYTHING FOR

Engineers and Draughtsmen

Faber's No. 368, Slide Rule, specially graduated for Electrical Computations.

THE ART METROPOLE
ARTISTS' AND DRAUGHTSMENS' MATERIALS
241 YONGE STREET
TORONTO

WRITE FOR CATALOGUE.

THE ART METROPOLE
241 YONGE STREET, TORONTO

The advertiser would like to know where you saw his advertisement—tell him.

SCANDINAVIA BELTING
TORONTO

This is the original solid woven belt. There are no plies to come apart. Made in three thicknesses.

Federal Engineering Company Limited

TORONTO MONTREAL

LUBRICATING OILS

Canadian Oil Companies, Limited

TORONTO MONTREAL ST. JOHN
HALIFAX WINNIPEG
REGINA CALGARY
NELSON

Self-Lubricating

In Cans
6, 12, 25 and 50 lbs.

SAFETY PLASTIC
METALLIC PACKING
LASTS FOR YEARS AND NEVER WEARS THE PISTON ROD

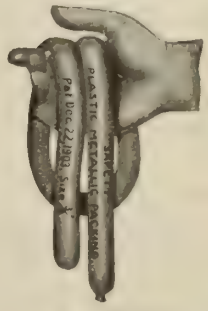
Guaranteed to stand steam temperature up to 550 degrees Fahr.
Guaranteed to stand hydraulic pressure to 5000 pounds per square inch
Packing furnished in bulk and in thin Cotton Tubes, sizes 3-16 to 1½ inch, 36 inches long, or in special lengths to fit your stuffing boxes.
Empty Cotton Tubing in assorted sizes FREE OF CHARGE with orders for the packing in bulk form.
The tubes are easily filled and they save you the expense of carrying a large stock of packings in different sizes.

Send for FREE SAMPLE and particulars

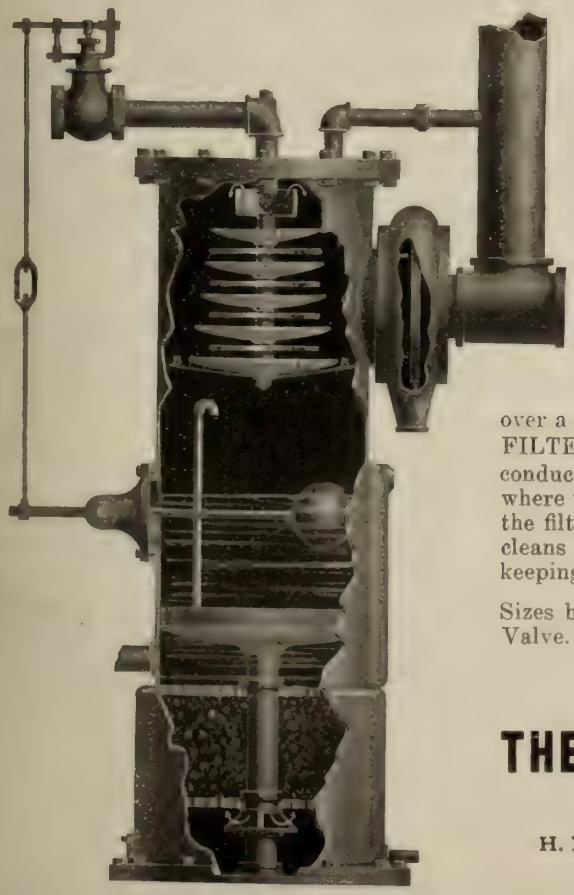
Manufactured only by

STEEL MILL PACKING CO. : WINDSOR, ONT.

Practically Frictionless



Sold on APPROVAL



The "SIMS"

Open Feed Water Heater Filter and Purifer

Is a Boiler Protector and Fuel Saver

It also saves water to the extent of the exhaust steam condensed in heating the feed water.

An Automatic Inlet Valve, which is controlled by a ball float, maintains an even water level. Perfect distribution of water in steam chamber is obtained by passing it over a series of trays or saucers, giving the effect of a shower.

FILTERING UPWARD through a bed of COKE is obtained by conducting the water to the bottom or Mud Chamber of the heater, where the heavier impurities settle by gravity, thence upward through the filter to the pump suction. Opening the Blow-Off Valve not only cleans out the mud chamber, but thoroughly flushes the Filter bed, keeping it in a high state of efficiency.

Sizes built—50 H.P. to 2,500 H.P., with or without By-Pass Cut Out Valve.

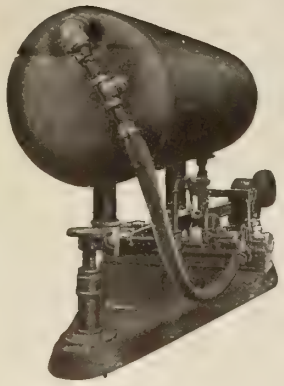
Write for Complete Details.

THE SIMS COMPANY, Erie, Pa.

CANADIAN REPRESENTATIVES:

H. L. Peiler & Co., 380 St. James St., Montreal, Que., and 84 Church St., Toronto, Ont.

The advertiser would like to know where you saw his advertisement—tell him.



The **Morehead Condenser Trap makes its own Vacuum**

and PULLS the accumulated water and air out of your steam lines, insuring rapid circulation. Enables you to cut down your boiler pressure on direct heating systems.

Particularly adapted for use in connection with reduced pressure and Exhaust Steam Heating Systems, Dry Kilns, Dryers, Fan Stacks, Etc.

Write for Particulars and a Trial Trap.

Canadian Morehead Mfg. Co.
WOODSTOCK, ONT.

THE
CANADIAN CASUALTY
AND
BOILER INSURANCE
COMPANY

ATTENTION:

In what condition have you left your heating boiler? we would like the privilege to inspect it, and report to you what has to be done before the next heating season.

CONTINENTAL LIFE BUILDING
TORONTO

J. O. B. Latour, Chief Engineer.
John J. Durance, Manager.

Phone Main 6941

Canadian Association OF Stationary Engineers

To all whom it may concern:

All those operating steam or electrical plants know that to advance in their special profession something new must be added constantly to keep up with the rapid developments in all the branches of the engineering profession. To you I offer the undisputed facilities and benefits to be derived by being a member of the C.A.S.E. This year has seen greater developments in our executive, owing to the aforesaid profession advancing so rapidly.

It is the wish of the present membership that all operating engineers should become members, so that we may hold our profession in the front ranks of scientific industry.

You will readily see the great advantages that would accrue from such a source.

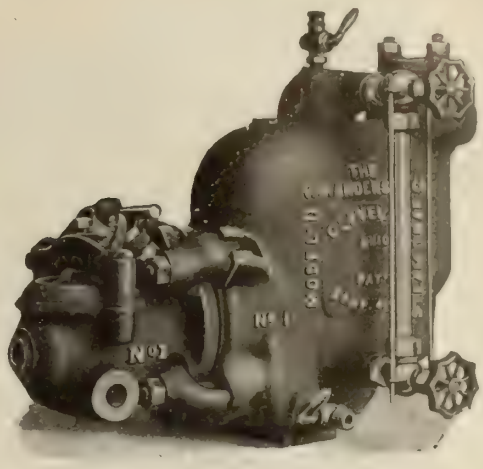
If not a member
Why not a member?

Act at once and write for further information concerning membership to

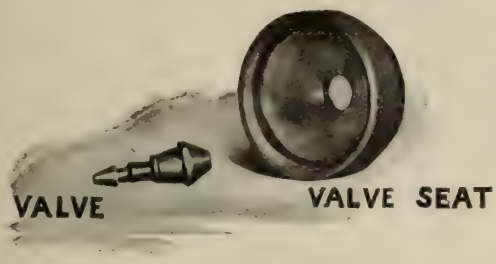
A. KASTELLA,
Executive Secretary,
62 Robert St., Ottawa

The Anderson Model "D" Steam Trap

Disposes of Condensation as Fast as it Accumulates in Steam Coils, Jackets, Radiators, Etc., Without Reducing Pressure or Permitting Live Steam to Escape.



The trap is so constructed that you can change the valve and seat from high to low pressure or vice versa in five minutes without disturbing, or unscrewing a single steam joint or pipe connection.



All parts are interchangeable, being machined to solid gauges, thus ensuring absolute accuracy.

A removable perforated strainer is part of the equipment. This prevents pieces of scale, packing lead, etc., from entering the trap.

Every trap is tested and inspected under boiler pressure by experts before leaving factory. Every Anderson Model "D" is guaranteed.

Write for descriptive booklet.

THE V. D. ANDERSON CO., West 96th St., Cleveland, Ohio

BRANCH OFFICES:—330 Manhattan Bldg., Chicago, Ill.; 619 Park Bldg., Pittsburg, Pa.; 3 Arch St., Philadelphia, Pa.; 212 Walnut St., Cincinnati, Ohio; 207 Union Trust Bldg., Baltimore, Md.; 91 High St., Boston, Mass.

Are You Giving Your Boilers A Square Deal?

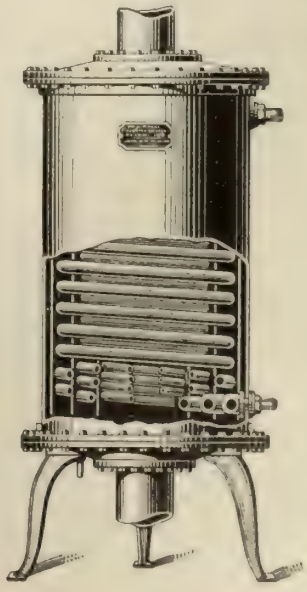
Not unless you give them hot water. Your boiler is a steam generator—it was not intended for a feed water heater.

Heating the water *in the boiler* reduces its capacity, takes more fuel, and the cold entering water causes violent strains due to unequal expansion and contraction.

Heating the feed water in a

NATIONAL FEED WATER HEATER

increases output of boiler, saves fuel by utilizing exhaust steam, reduces wear and tear, saves labor, saves worry.



ASK FOR CATALOGUE No. 1

The National Pipe Bending Company

91 Lloyd Street, New Haven, Conn.

Makers of Pipe Coils and Bends of Every Description — for All Purposes—Copper, Brass, Iron.

46-25

The advertiser would like to know where you saw his advertisement—tell him.

When Buyers Forget to Forget

When competition ceases to compete; when every actual and prospective customer has been convinced that your product is the best of its kind and nothing better can be produced, then, and only then, will it be safe to

Get Along Without Advertising

Just so long as old buyers die and new ones take their places; just so long as there is competition to coax your customers from you; just so long as there is a possibility that somebody else will produce a better product, just on long will it be important, **absolutely necessary,** to carry on the work of educating and reminding your own and your competitors' customers as to your goods.

And just so long as the buyers and prospective buyers in a given trade or profession subscribe to the publications representing that trade or profession, just so long will there be no better way to reach and impress them with your business story, than through the technical and trade publications which they look to and depend upon for information which enables them to compete successfully along their own lines.—Selling Magazine.

Manufacturers of power equipment and supplies should bear in mind that The Power House has behind it a subscription organization unequalled in Canada. Our records are open for your inspection.

In considering your advertising campaign, is it not good business to place your appropriation with a medium through which you can reach the largest number of buyers in your field?

We will be glad to quote you rates.

THE POWER HOUSE

143-149 UNIVERSITY AVE., TORONTO

CHICAGO:
Room 607, Marquette Bldg.,
140 S. Dearborn St.

NEW YORK
115 Broadway

EUROPEAN OFFICE
88 Fleet Street, London, E.C.

MONTREAL
Eastern Townships Bank Bldg.

WINNIPEG
34 Royal Bank Bldg.

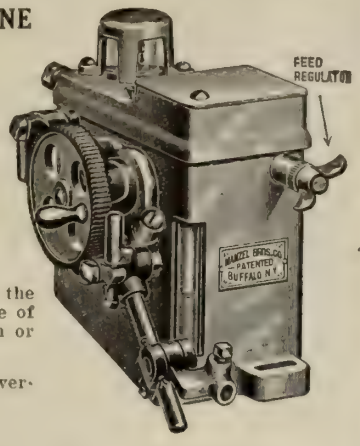
MANZEL

AUTOMATIC FORCE AND SIGHT FEED **Oil Pump**

Saves 50% of YOUR OIL

LET US SEND YOU ONE ON APPROVAL.

If at the end of thirty days you find that it should not save as we guarantee, you can send it back at our expense, and there will be no charge against you. With this Pump, Oil is fed into the Cylinder **regularly and positively** all the time—no matter how slow the engine runs, what pressure of steam is carried, how high or low the temperature.



You cannot afford to overlook this trial offer.

Write to-day.

THE TWIN CITY OIL COMPANY

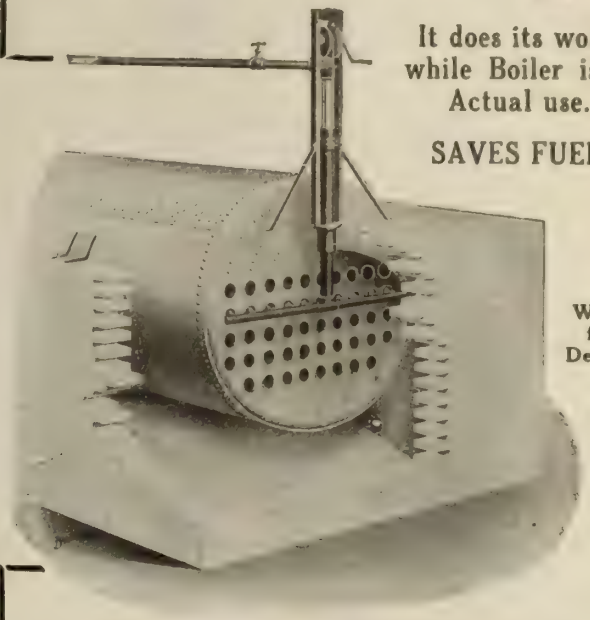
General Agents for Canada

BERLIN, - - ONTARIO

MANZEL BROTHERS COMPANY, BUFFALO, N.Y.

You can clean your Boiler Tubes at a Saving of much Time and Labor with

"The Henry" Steam Flue Cleaner



It does its work while Boiler is in Actual use.

SAVES FUEL!

Write for Details

THE STEAM APPLIANCE CO.

MILWAUKEE, WISCONSIN.

CANADA SALES CO., Donalda Bldg., Winnipeg

Machine Banded Wood Stave

WATERPIPES and TANKS

For city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited

P.O. Box 563 Vancouver, B.C

WRITE FOR CATALOGUE

Full Particulars and Estimates Furnished

KEEP YOUR BOILERS FREE FROM SCALE

And Save Fuel, Time and Money

By Using

WALKER'S ELECTRIC BOILER COMPOUND

High Grade Oils

Regal Valve Oil
Red Star Cylinder Oil
Monarch Cylinder Oil
Superior Engine Oil
Electric Engine Oil
Vulcan Machine Oil
Heavy Red Machine Oil
Brush Dynamo Oil
Gas Engine Oil and all Engine Supplies

A very small quantity used regularly will keep your boiler tubes **absolutely** clean, and prevent pitting, corrosion, foaming, etc.

The ingredients used in making this compound are harmless to metal; therefore it cannot injure tubes or fittings.

Give it a trial and you will always use it.

The Electric Boiler Compound COMPANY, LIMITED

Guelph, - - Ontario

The advertiser would like to know where you saw his advertisement—tell him.

Use Stephenson Bar Belt Dressing

Make 1913 a record breaking year. Turn over a new leaf and get rid of the things that have been causing needless trouble and expense. Adopt the things which will make your work easier, give better results and save money for your employer. You cannot start at a better place than with your belt dressing.

Get rid of your troublesome liquid dressing. Shake the can for the Stephenson solid stick and shake trouble at the same time.

Stephenson Bar Belt Dressing is a friend in need. It doesn't require preparation, nor do you have to use special care in applying it. The minute the belt slips you hold the Stephenson bar to the belt for a few seconds and the slipping stops. There's no waste—no slop—no smearing on of paste or pouring on of spattering liquid. And the results are better.

I'll **"Stick to the Solid Stick"**

Start With a Free ½ Lb. Sample

Simply send us your name and address and we'll send you a present in the shape of a free half-pound sample of Stephenson Bar Belt Dressing.

Remember—we give you this sample absolutely free of charge. Get this free half-pound of the finest belt dressing made and test it. Here's your chance to try somesomething really good at no expense.

None Genuine Without Trade-Mark

Stephenson Manufacturing Company

Est. 1888 Albany, N.Y. **Inc. 1897**

The advertiser would like to know where you saw his advertisement—tell him.

D. K. McLaren's

Genuine British Oak Tanned

Leather Belting

Will Increase Your Profit by Decreasing Up-Keep Expense

Experts supervise every step in the manufacture of D. K. McLaren's Leather Belting. It is thoroughly stretched before being placed on the market, and guaranteed to give complete satisfaction.

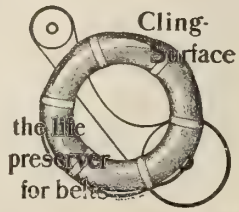
You should be interested to hear what users have to say. Let us send you names of some users. Write them and profit by their experience.

Drop us a card to-day.

D. K. McLaren, Limited

Montreal 351 St. James St. | **Toronto** 200 King St. W. | **Vancouver** 37 Alexander St. | **St. John, N.B.** 64 Prince William St.

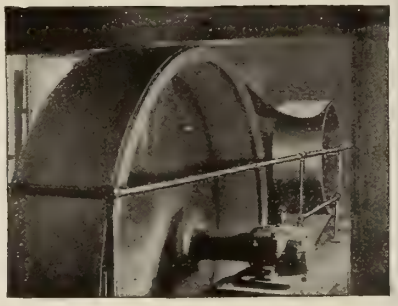
OUR NEW TRADE MARK



This mark, which will now appear on the label of every package of genuine Cling-Surface, symbolizes two benefits assured to power users only by systematic Cling-Surface treatment of belting and transmission ropes.

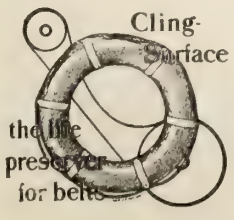
First, the preservation of the belt or rope fibres due to the food value of Cling-Surface in replacing spent natural ingredients, and in resisting climatic changes, moisture, steam, etc.

Second, the economic advantage of slipless belts and ropes run slack, as made possible by increased pulley contact arcs and the "cling" imparted by Cling-Surface to the belt face or rope surface.



Cling-Surface owes its success largely to penetrating and lubricating qualities. Instead of making the belt sticky, it leaves the surface soft and clean and makes the interior flexible. Thus a belt is put into condition that permits easing and relief of the strain within, and on the pulleys, hangers and bearings. Belts so slackened effect a direct power saving, lessen wear on the journals, minimize the danger of hot boxes, lessen the frequency of lubrication, make less lubricant necessary, seldom need repair attention and minimize shut downs.

Send us a trial order for Cling-Surface and we will send you valuable literature on the care of your belting and ropes. (We quote f.o.b. Toronto.) And if you are not entirely satisfied with results from Cling-Surface you can have your money back.



Cling-Surface Co

1057 Niagara Street
Buffalo N Y

67

10,000 K.W. Turbo-Generator Set

POWER PLANTS, ROLLING MILLS, MINING, HOISTING MACHINERY

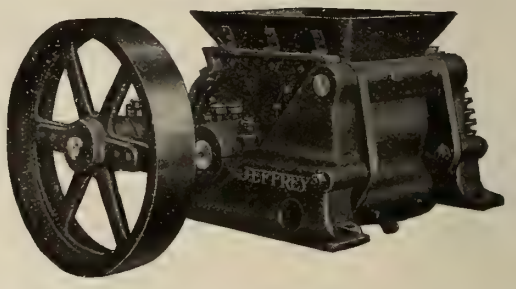
ELEVATORS PATIENT "STIGLER"

Builders under patents of "STE. ALSACIENNE"

Belfort (France) Mulhouse Grafenstaden (Germany)

Engineering Works of Canada

MONTREAL Quebec



Insure a Constant Supply of Small Coal for Your Stokers

Delay in shipments or other causes may compel you to substitute larger sized coal. This means increased fuel costs.

A Jeffrey Single Roll Crusher

Will reduce Lumps and Run-of-Mine Coal to stoker or any desired size in a single operation.

The machine can be started up under full load, and cannot be flooded or choked down.

Consumes but little power, costs but little to install, occupies but little space.

Bulletin No. 41 fully illustrates and describes it. Write for copy.

JEFFREY MFG. COMPANY

Canadian Main Office and Works, MONTREAL

Winnipeg Representatives, N. J. DINNEN & CO.

New Detroit Grease Lubricator

The new Detroit "300" Grease Lubricator feeds grease, non-fluid oils and similar lubricants evenly, efficiently and economically. It is much the same in construction as the Detroit Improved Standard Lubricator.

The heating chamber is of sufficient size to reduce all the lubricant in the reservoir to a thoroughly liquid condition immediately after steam is turned on. No time is lost waiting for the lubricator to warm up before feeding.

Cold drafts and temperature variations cannot affect the Detroit "300" in any way. The oil or grease in every part of the lubricator is maintained in a fluid condition at all times, with an even rate of feed, fine regulation and maximum economy as results.

The "300" Grease Lubricator is only one of the new devices introduced by the Detroit Lubricator Company.

Detroit Lubricators have kept pace with every advance in mechanical practice. Whenever a new machine is brought out or a new condition arises, the Detroit Lubricator Company has designed immediately a lubricator for that service—if, indeed, the complete line did not already contain a device that would meet requirements.

Every Detroit Lubricator embodies all the improvements and refinements made possible by long experience in the sale and manufacture of lubricators and by careful study of over 1,250,000 lubricators in use on all kinds of engines all over the world. The Detroit is the world's standard of excellence in lubricating devices.

The big 232-page Detroit catalog tells all about the different kinds of lubricators and other Detroit products—gives complete instructions for installation, care and operation, and contains much valuable information on the general subject of lubrication.

Write for catalog G-58.

CANADIAN DETROIT LUBRICATOR COMPANY, LTD.

WALKERVILLE, ONTARIO

SEND ME A BOX OF BABBITT
THE KIND THAT DOES NOT WEAR OUT

WE RECEIVED A LETTER from a customer a few days ago, the following is an extract, "Send me a box of Babbitt, same as last, I forget the name, but it is the kind that does not wear out."

This is a Testimonial Indeed and one Straight from the Heart.

The writer of the letter above mentioned had evidently got a Babbitt Metal just suited to his specific purpose.

THAT IS WHERE WE EXCEL. We can advise you, it costs you nothing to take advantage of our years of practical experience. If you have Babbitt Troubles, why not ask our advice?

WE RECOMMEND

IMPERIAL GENUINE "The Highest Grade of Babbitt Metal manufactured" for all High Speed Engines and Bearings carrying extremely heavy loads.

HARRIS HEAVY PRESSURE "The Babbitt Metal Without a Fault" for all General Machinery Bearings.

ALUMINOID For Medium and Light Running Machinery.

EVERY USER OF BABBITT METALS SHOULD GET OUR PRICES.

THE CANADA METAL CO., Limited

Head Office and Factory: TORONTO. Branch Factories: MONTREAL, WINNIPEG

The advertiser would like to know where you saw his advertisement—tell him.

"Maple Leaf" Brand

Stitched Cotton Duck Belting

THE BEST FOR ALL KINDS OF BELTS

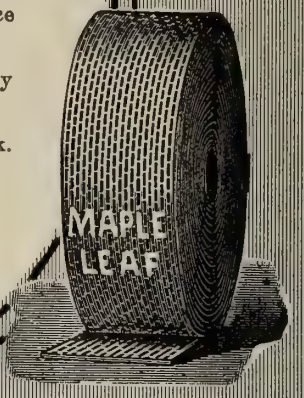
Means Reduced Upkeep Expense and Efficient Service

There is a "Maple Leaf" Belt for every service from the heaviest drive to the smallest light belt.

It is durable under dry or wet conditions, and is by far the most economical belting that you can use.

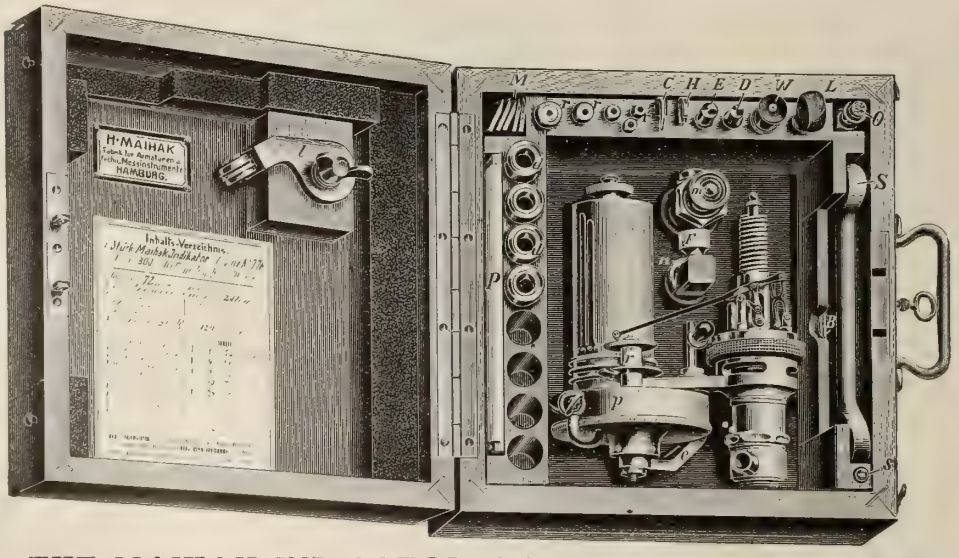
It is made by experts from plies of selected duck. Absolutely guaranteed.

Ask us for further information and prices.



Dominion Belting Co., Ltd.,

HAMILTON, CANADA



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This indicator made in Germany is the best in the world.

Outside spring, and easily exchanged.

Indicator Specialties; Locomotive Indicators with Electrical Attachment; Bottcher's Efficiency Reckoners; Spring Testing Plants.

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Solve Coal, Machinery and Merchandise Handling Problems.

Hand, Pneumatic and Electrically Operated.

Tell us what you wish to do, and we'll suggest the proper equipment for you.

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Engineers and Manufacturers

20-30 Cooper Ave. **TORONTO**

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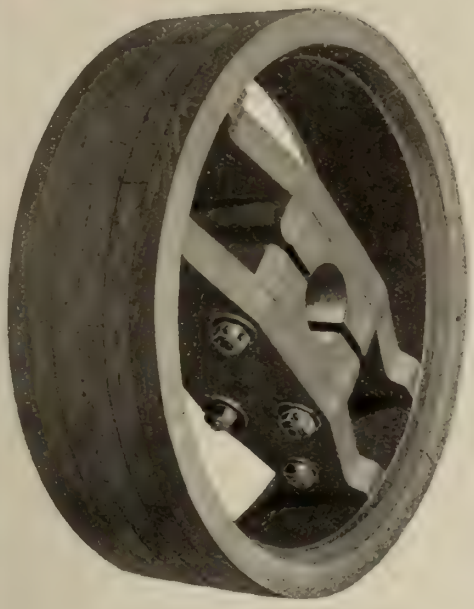

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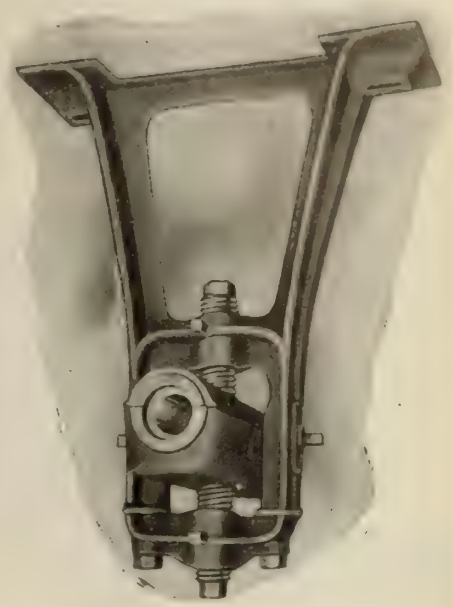
Elmira Wood Split Pulleys

The Elmira B. & S. Hangers are designed to meet the hardest and most exacting conditions. They are of good weight, correct design, and well proportioned. A Duplex system of oiling is employed consisting of tempered steel rings and woven cotton wick.

The Elmira Pulley is built to stand the hardest service and most severe conditions. The rim is nailed throughout. The arms are tenoned into the rim and dowelled there. The pulley is guaranteed to run wherever a leather belt will give satisfaction.

Send for our Illustrated Catalogue "C"

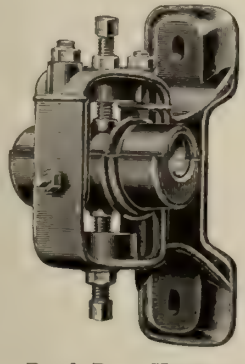


Large and complete stocks carried at Elmira, and by

The A. M. ELLICOTT CO., 301 St. James Street, Montreal, Que., Sole Eastern Agents.

Elmira Machinery & Transmission Co., Limited - - Elmira, Canada

The "Bond" Patent Spiro Compression Coupling
50% more gripping force than any other Compression Coupling.



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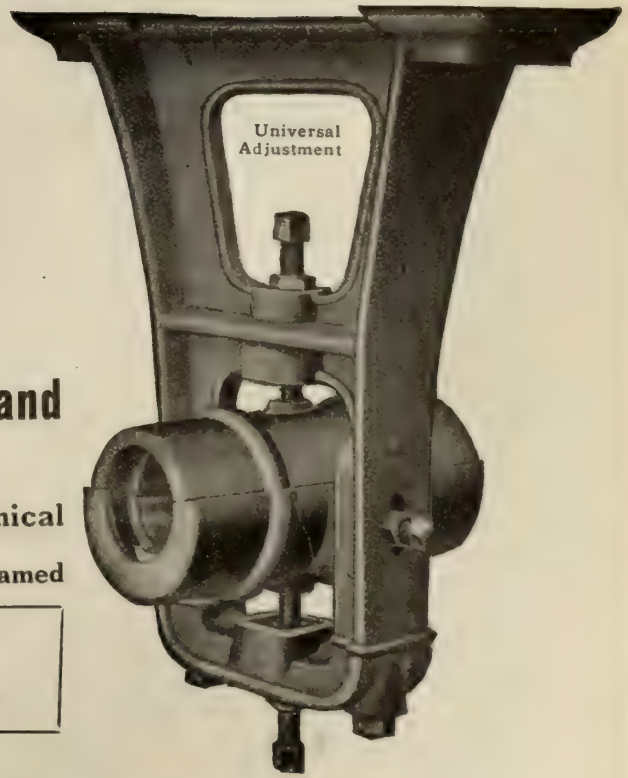
"Bond" Hangers and Couplings

Are Efficient and Economical

All Bearings are Babbitted and Reamed

"Bond" Service is unequaled. A TRIAL WILL CONVINCE YOU.
Write for complete Catalogue No. 25.



The "Bond" Patent Universal Ring Oiling Ball and Socket Hanger.

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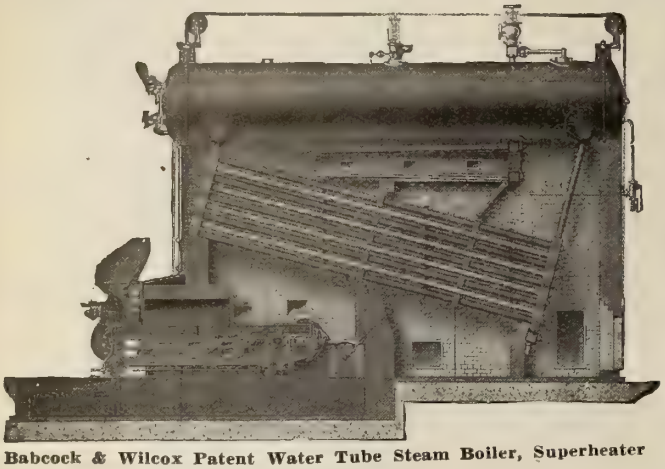
With Furnaces for all Classes of Fuel or Waste Gases

HIGHEST ECONOMY, SAFETY, DURABILITY. OVER 10,000,000 H.P. IN USE



Babcock & Wilcox Patent Water Tube Steam Boiler, Superheater and Mechanical Stoker.

ALSO

Steam Superheaters
Mechanical Stokers
Coal-Handling Machinery
Piping, Feed Water Heaters
Water Softeners and Purifiers
and **ELECTRIC CRANES**

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Last year, 1912, was the best year the Dearborn Company has ever had.

That fact is especially significant when you think of the number of imitators who come and go — who copy the idea but can't deliver the goods.

We were the pioneers in the feed water treatment business—to-day we've the largest house in this line.

Dearborn Treatment is cleaning boilers and keeping them free from scale, and other ill effects of the feed water in all parts of the world.

And our whole success is due to the fact that our treatment is individual treatment, made specially for each particular case.

We analyze over 8,000 samples of feed water annually and prescribe suitable treatment.

Don't let boiler troubles worry you any longer—send a gallon sample of your feed water to us—to-day. We'll analyze it FREE and let you know how little it will cost to keep your boilers in constant good condition.

DEARBORN CHEMICAL COMPANY

General Offices, Laboratory and Works - - - - CHICAGO

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To our Readers:—Use this directory when seeking to buy power equipment or supplies. You will often get information that will save you money.

To our Advertisers:—Send in your name for insertion under the heading of the lines you make or sell.

To Non-Advertisers:—A nominal rate of $1 per line a year is charged non-advertisers.

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Can. Westinghouse Co., Hamilton.
Escher, Wyss & Co., Toronto.
Fraser & Chalmers, Ltd., Montreal.
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Smart-Turner Machine Co., Ltd., Hamilton.

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Canadian Steam Boiler Equipment Co., Toronto.

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Can. Gen. Elec. Co., Ltd., Toronto.
Can. Westinghouse Co., Hamilton.

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Jones Cold Store Door Co., Hagerstown, Md.
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F. Reddaway & Co., Montreal.

Belting, Stitched Cotton Duck.
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General Supply Co. of Can., Ottawa.
Main Belting Co., of Canada, Montreal.
Manitoba Bridge & Iron Works, Ltd., Winnipeg.
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Dunlop Tire & Rubber Goods Co., Toronto.
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National Pipe Bending Co., New Haven, Conn.

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Fraser & Chalmers, Ltd. Montreal.
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Perolin Co. of Canada, Toronto.
Dearborn Chemical Co., Chicago.
Electric Boiler Compound Co., Guelph, Ont.
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Canadian Steam Boiler Equipment Co., Toronto.
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Smart-Turner Machine Co., Ltd., Hamilton.

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Federal Graphite Mills, Cleveland.

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Canadian Fairbanks-Morse Co., Ltd., Montreal.
Darling Bros., Montreal.
Lunkenheimer Co., Cincinnati, O.
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Engineering Works of Canada, Ltd., Montreal.
Fraser & Chalmers, Ltd., Montreal.
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Jones Underfeed Stoker Co., Toronto.
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Ogilvy Eng. Co., Montreal.
Polson Iron Works, Toronto.
International Engineering Works, Ltd., Amherst, N. S.
Waterous Engine Wks. Co., Brantford

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Goldie & McCulloch Co., Galt.
Canada Fdry. Co., Ltd., Toronto.
Fraser & Chalmers, Ltd., Montreal.
Jenckes Machine Co., Sherbrooke, Que
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Manitoba Bridge & Iron Works, Ltd., Winnipeg.
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Fraser & Chalmers, Ltd., Montreal.
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John McDougall Caledonian Iron Wks, Montreal.
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Hare Eng. Co., Toronto.
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Waterous Engine Wks. Co., Brantford

Conveyor Belting.
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Can. H. W. Johns-Manville Co., Toronto.

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Babcock & Wilcox, Montreal.
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Canada Foundry Co., Ltd., Toronto.
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Goldie & McCulloch Co., Galt.
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International Engineering Works, Ltd., Amherst, N. S.
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Engineering Works of Canada, Ltd., Montreal.
Goldie & McCulloch Co., Galt.
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E. Leonard & Sons, London, Ont.
John McDougall Caledonian Iron Wks, Montreal.
International Engineering Works, Ltd., Amherst, N. S.
Waterous Engine Works Co., Brantford.

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Dearborn Chemical Co., Chicago.
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Can. Fairbanks-Morse Co., Montreal.
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Darling Bros., Montreal.
Elliott Co., Pittsburgh, Pa.
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National Pipe Bending Co., New Haven, Conn.
H. L. Peiler & Co., Montreal.
International Engineering Works, Ltd., Amherst, N. S.
The Sims Co., Erie, Pa.
Waterous Engine Works Co., Brantford.

Feed Water Regulators.
Canada Foundry Co., Ltd., Toronto.
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Flue Brushes.
Steam Appliance Co., Milwaukee, Wis.

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Canada Foundry Co., Ltd., Toronto.
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Jones Cold Store Door Co., Hagerstown, Md.

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Canadian General Electric Co., Ltd., Toronto.

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Goetze-Gasket & Packing Co., New Brunswick.
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Canada Foundry Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
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Gears, Spur Level.
Manitoba Bridge & Iron Works Limited, Winnipeg.
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Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.
Northern Electric & Mfg. Co., Limited, Montreal.

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W. H. Allen Son & Co. Bedford, Eng.
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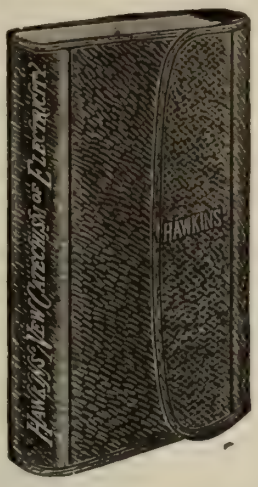

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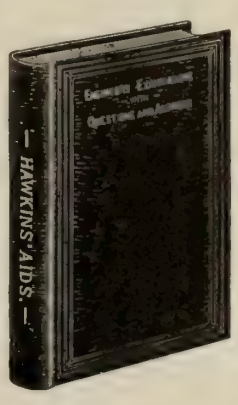

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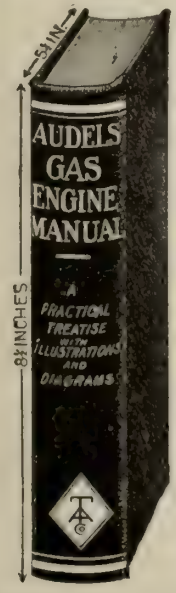

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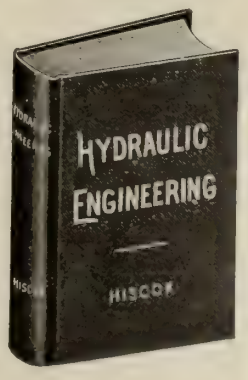

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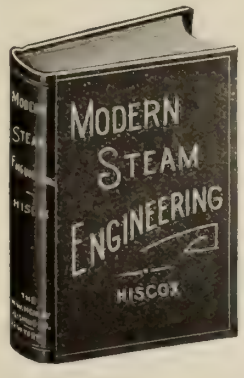

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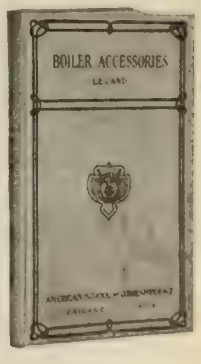

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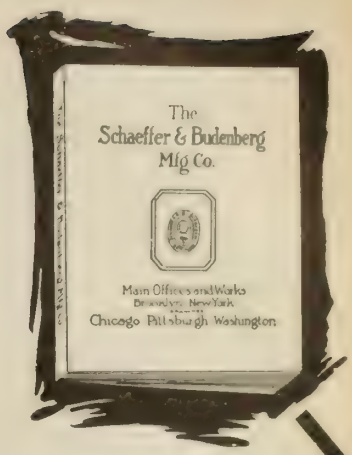

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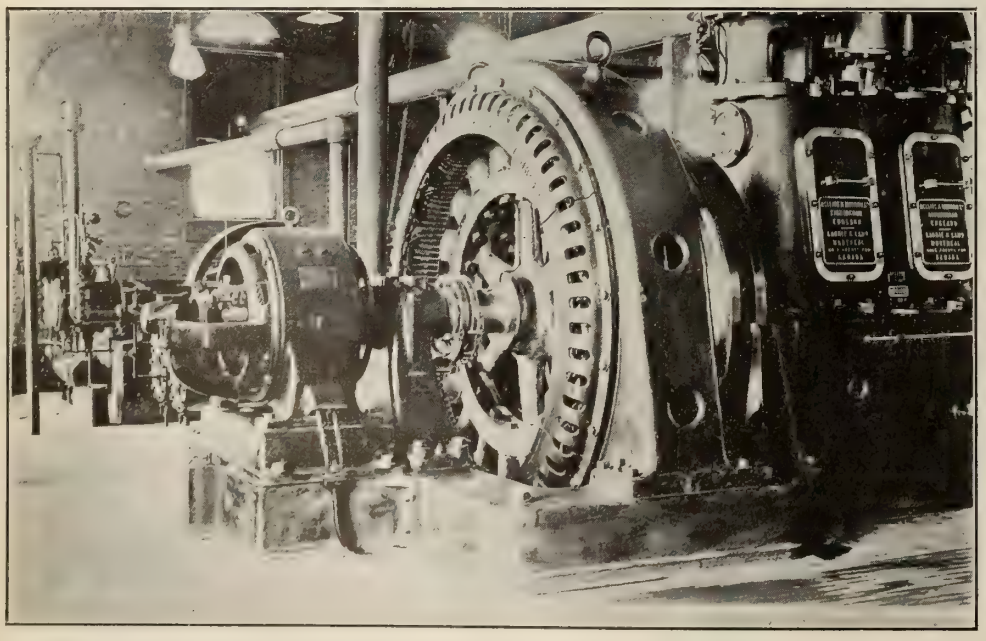

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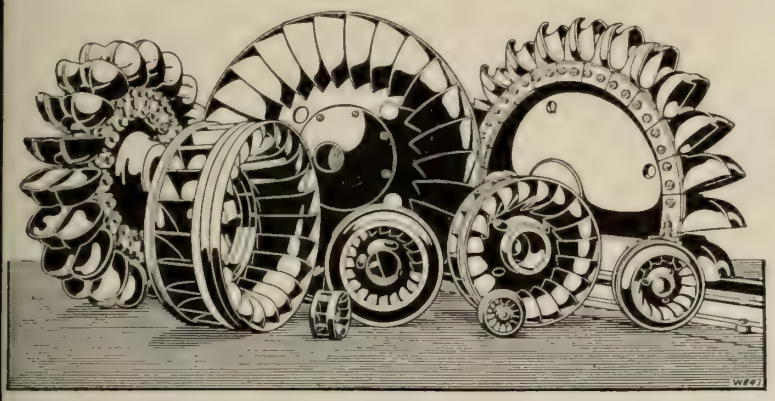

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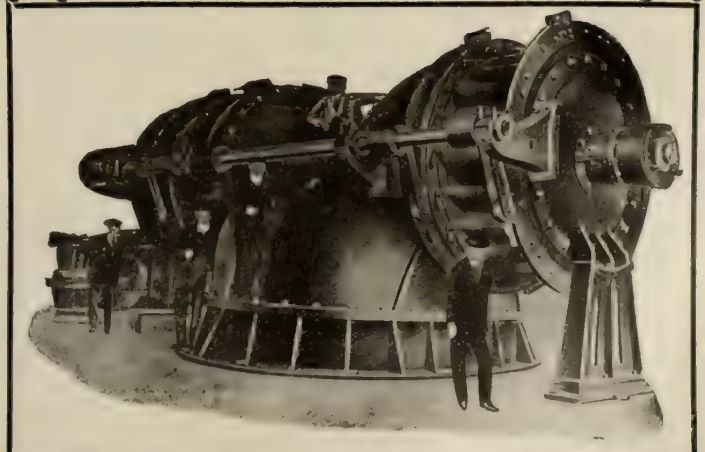

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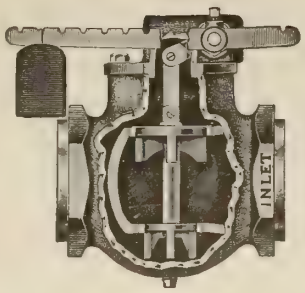

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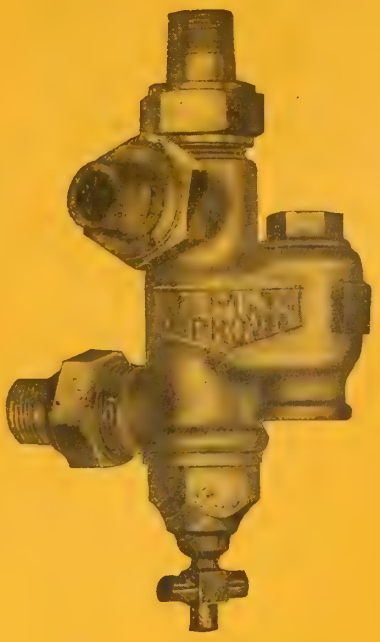

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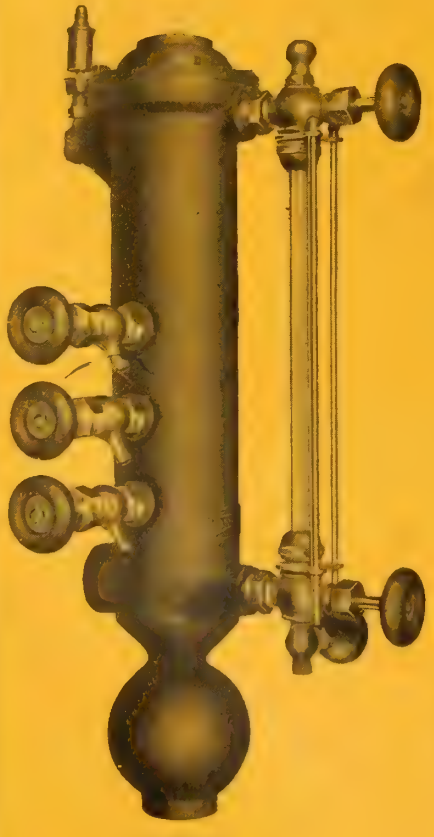

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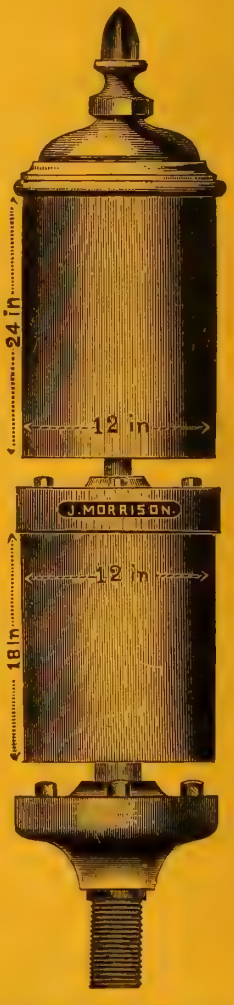

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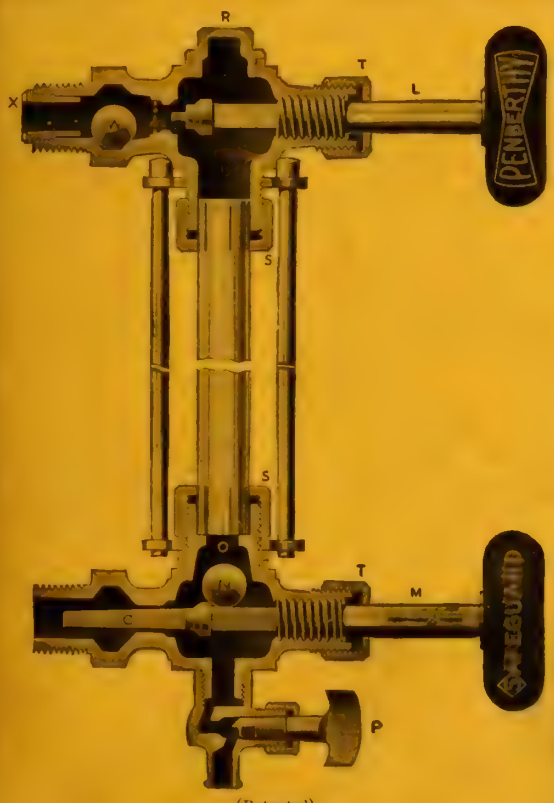

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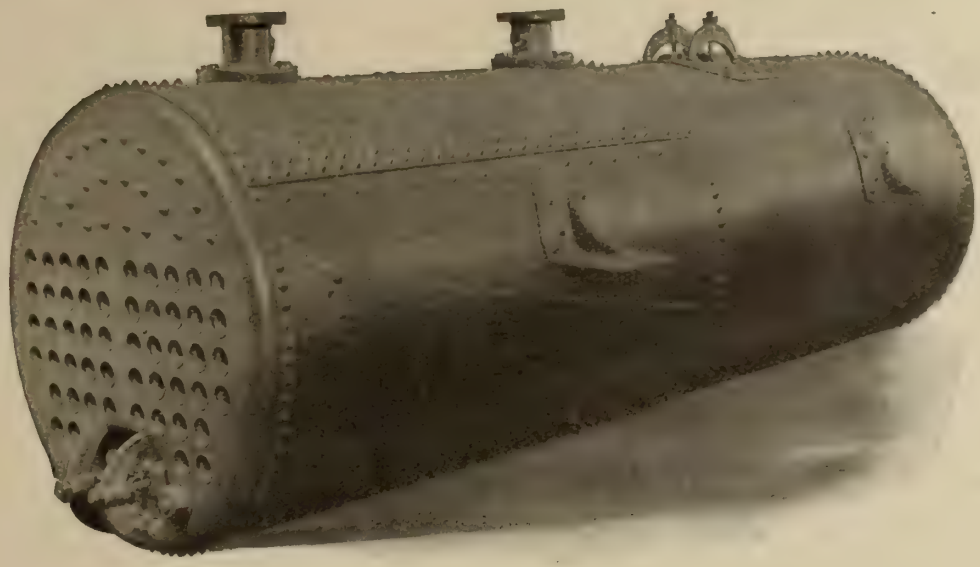

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A Dunham Vacuum System Will:-

Insure heat in every radiating unit without loss of steam.

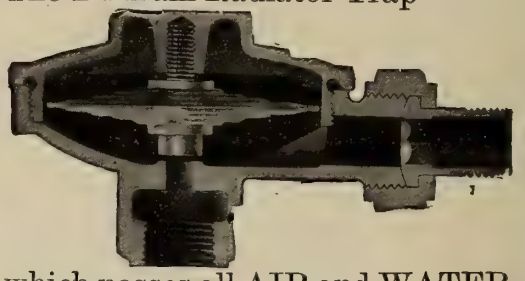
Eliminate all troubles from freeze-ups.

Reduce back pressure on your engine to a minimum (means greater engine economy).

Effects a large saving in your coal bill.

By Use Of

The Dunham Radiator Trap



which passes all AIR and WATER, closes off against STEAM, and proven durable by years of service.

Let us direct you to many satisfied customers who have changed their old unsatisfactory, troublesome system into a Dunham.

Our Engineering Staff is at your disposal

C. A. DUNHAM CO., LTD., Toronto, Can.

Halifax Montreal Vancouver Winnipeg Calgary

Sales Over Five Million Dollars Annually

Four Babbitt Manufacturing Plants

TORONTO LONDON, ENG. NEW YORK ST. LOUIS

Faultless "A" This babbitt is a high grade copper hardened alloy, possessing in a higher degree all the good points of the original Genuine Babbitt, with increased antifriction qualities, having the additional merit of absorbing and holding oil. It is used extensively in France for automobile engines, and in South Africa for mining machinery, and in United States and Canada for marine engines, dynamos and all heavy duty machines. Where heavy service is required this will last longer than any Genuine Babbitt manufactured. For heavy duty, saw mills and engines it is without equal.

Eagle "A" Thousands of tons of this alloy have been placed on the market, giving such perfect results, that it's name and merits are known, we believe, as extensively as any other babbitt manufactured. Its high antifriction and heavy duty qualities make it especially adapted for saw-mills, planing-mills, threshing engines, traction engines, pumps, rolling-mills and general machine shop use.

HOYT METAL COMPANY

TORONTO OFFICE AND MFG. PLANT—EASTERN AVE. AND LEWIS ST.

The advertiser would like to know where you saw his advertisement—tell him.

HIGHEST JENCKES BOILERS QUALITY

VERTICAL TUBULAR
HOROZONTAL TUBULAR
LOCOMOTIVE TYPES
HEATING BOILERS

We have the facilities for turning out high grade boilers to meet every requirement on short notice.

Jenckes Boilers are made to conform with the various Provincial Inspection Acts. Every one has to pass a rigid test and inspection under **high** pressure before leaving the works.

Jenckes Boilers will minimize your stoppage for repairs.

If you are contemplating installing a new boiler it will be to your advantage to investigate the product of **our** boiler department.

We will be only too glad to put you in touch with some users so that you can profit by their experience.

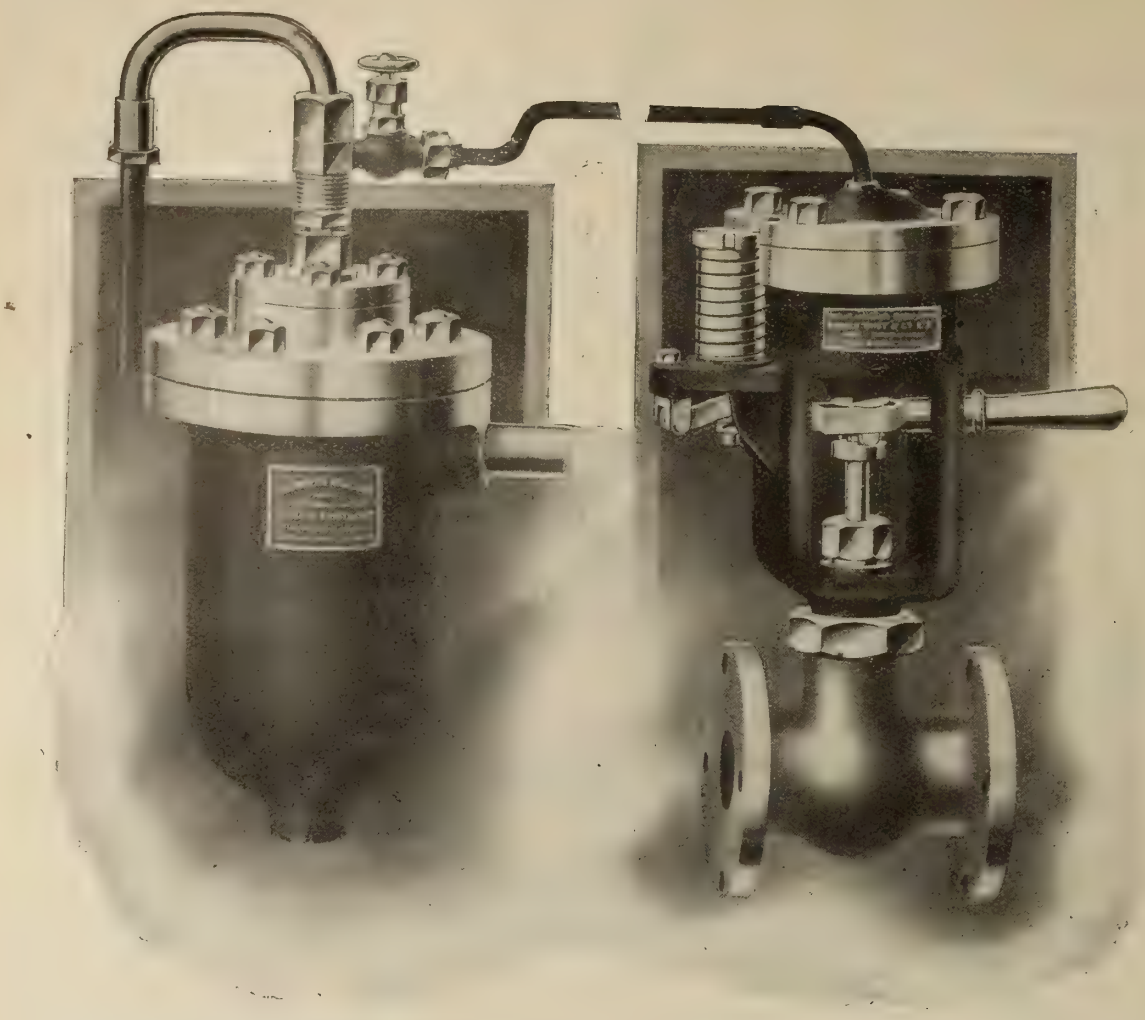
Write for catalogue.

Our Boiler department with boilers in various stages of construction

The Jenckes Machine Co., Limited

Sherbrooke Montreal St. Catharines Cobalt South Porcupine Nelson Vancouver

Works: SHERBROOKE, QUE. ST. CATHARINES, ONT.



IN a Steam Boiler IT IS recognized that the balance of fuel to feed is economical as well as necessary, but the degree or fineness in the adjustment of these two factors is not so generally appreciated, and the reason is specifically interesting; being that no more reliable or accurate means than hand control has ever been successfully devised, so that the problem of fine feed regulation has been left as inopportune, and the losses resulting have been considered as necessary and unavoidable. This is no longer so—the Thermofeed Regulator first makes it necessary to calculate what the losses on the fluctuating levels are, and then prevents those losses entirely.

Send us trial order, giving feed-water temperature, size of feed line, with working pressures—we will do the rest.

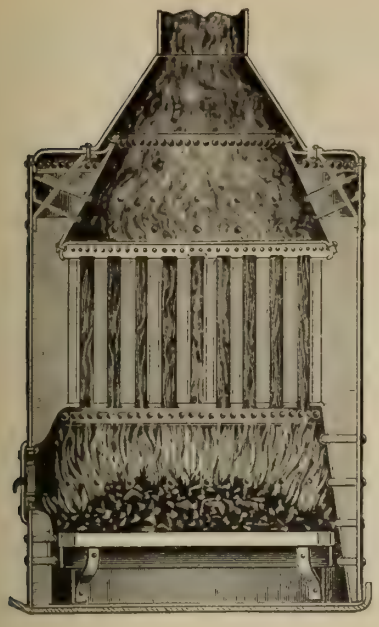
We most assuredly can save some of your losses, and the extent to which we can do this will surprise you—it is our special care and study.

RONALD TRIST & Co. Limited

4, Lloyds Ave., LONDON, E.C., England, and 62, Robertson St., GLASGOW, Scotland.

Branches at Manchester, Liverpool, Paris and Vienna.

Telegrams and cablegrams RESVALAR, London, Glasgow and Manchester.



You Will Benefit By

a thorough investigation of our boilers.

They are the result of long experience, best materials and expert supervision.

Look up the past and present record of our boilers.

We will take the greatest pleasure in getting you in touch with some users—the evidence of users will cost you nothing. Our boilers will do the same for you as they do for others.

WRITE TO-DAY.

We build various types:

Scotch, Clyde, Fitzgibbon, Vertical, Mosher.

Highest Grade BOILERS

Horizontal, Tubular, Vertical, Locomotive Type, "Heine" Water Tube.

Polson Iron Works,

LIMITED

Steel Shipbuilders, Engineers and Boilermakers

TORONTO, CAN.

Representatives in Canada for

The B. F. Sturtevant Co., Hyde Park, Mass., U.S.A. Fans, Blowers, Heating and Ventilating.

The John I. Thornycroft Co., London, Eng., Marine Motors.

Garlock Boiler Graphite

We do not claim **Garlock Boiler Graphite** will remove old hard scale; nor will anything else, without injury to the Boiler

BUT

Garlock Boiler Graphite will do more towards removing old scale than anything else, and will not injure the boiler.

BECAUSE

It Acts Mechanically—Not Chemically

It's the Graphite that does it.

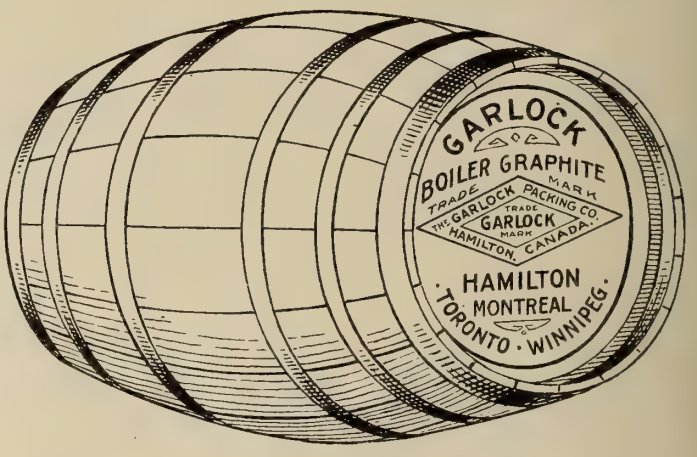
Garlock Boiler Graphite while circulating with the water through the boiler, will attack, soften and so disintegrate old scale that it may be easily removed, and will impart to the steel of the boiler a graphite finish on which new scale will not readily form. What little does form will be soft and so mixed with the Graphite as to be easily removed.

GARLOCK BOILER GRAPHITE MEANS { **Maximum Efficiency** / **Less Fuel** / **Boiler Cleaning Made Easy** } **Reducing the COST**

Let us send **You** a barrel on 60 days trial at our expense. **Try it.** Keep it if you like it. If not satisfactory, return the unused portion, charges collect. We are not taking any chances. **We know what Garlock Boiler Graphite will do.**

Put up in barrels and half-barrels.

Write for samples and price lists.



The GARLOCK PA

HAMILTON,

MONTREAL · **TO**

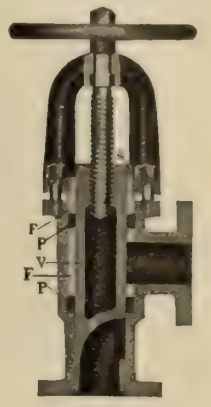
PIONEERS IN TH

The advertiser would like to know where you saw his advertisement—tell him.

Simplex Blow-off Valves

We are Canadian agents for *The Simplex,* the only *Seatless Blow-off Valve.*

A Blow-off Valve is used expressly for removing dirt, mud, sediment and scale from the boiler, and the very fact that this hard, gritty matter must pass through the Blow-off with such terrific force, has made it impossible to prevent the constant destruction of the Valve Seat. As a consequence the Blow-off Valve has been a continued source of trouble and expense.



The **Simplex Seatless Blow-off Valve** embodies the only solution of the problem. Not by attempting to improve the seat, but, **by eliminating it altogether.** The **Simplex has no Seat, to Stick, Clog, Wear or Leak.**

Cheerfully sent on 30 day free trial.

Further information and discounts on request.

Garlock Gaskets

The reputation of *Garlock Gaskets* has long been established, and their ever-increasing sale demonstrate their worth.

GARLOCK HIGH PRESSURE ASBESTOS GASKETS

made from long fibre Canadian asbestos and fine brass wire—absolutely heat proof. Cannot vulcanize or blow out under any steam pressure. They have proven without an equal on High Pressure Boilers.

GARLOCK HIGH PRESSURE TUBULAR ASBESTOS GASKETS

made from long fibre Canadian Asbestos with lead insertion. A very convenient form of Gasket. Can be shaped any position, and when once put in will stay.

GARLOCK RED TUBULAR GASKETS

made from same stock as our celebrated Red Sheet, put up in a form similar to our Tubular Asbestos Gasket.

They have all the advantages of the old style Tubular Gaskets, but with greater wearing and resisting power.

WE ALSO HAVE

Garlock Adjustable Gaskets. Garlock Gasket Tape. Garlock Red Sheet Gaskets.

KING COMPANY

CANADA

TO - **WINNIPEG**

CKING BUSINESS

The advertiser would like to know where you saw his advertisement—tell him.

The Greatest Allround Packing Known

"SPRINGBAK"

¶ That's the name we have given it and it's patented not only in the U. S. and Canada, but all over the world. Use it on

Steam, Hot Water, Cold Water, Ammonia, Air.

It is the one and only packing that is ideal for

Boiler Feed Pump Plungers and Rods

and we'll stand back of each and every pound you buy.

¶ Test the friction and flexibility; take any size between your thumb and finger and see what a fine cushion the "hole" makes. It is not necessary to squeeze "SPRINGBAK" hard—with only **half the pressure** it packs just as well, and as a consequence there is **much less friction**—your lubrication lasts twice as long—you have lightened your load—you show a saving in coal.

¶ Now, listen! It **costs less** because it **weighs** less.

¶ It wears longer because it is **all** quality. It is tough and elastic. It has an **oil proof** air chamber or oil duct. It expands in any direction 100 per cent., and then some. It yields to the pressure and promptly **returns to its original form** when pressure is lessened. Use any one of its four sides for the wearing service. Make "SPRINGBAK" your standard packing and reduce the stock of different styles you now feel compelled to carry by an even half dozen.

¶ Made in all sizes from $\frac{3}{8}$ in. to $1\frac{1}{2}$ in., inclusive.

Rings	**Spiral**	**Coil**
Style No. 123	Style No. 223	Style No. 323

For Piston Rods of Jones Stokers try Style No. 1204. We carry sets in Stock all ready to apply.

Remember, too, that we are Direct Importers of TAURIL Genuine Sheet.

WRITE US FOR CIRCULAR AND CATALOGUE MATTER

THE ANCHOR PACKING COMPANY

of Canada, Limited

WALKERVILLE **MONTREAL** 404 St. James St. **TORONTO** 205 Yonge St. **WINNIPEG** 63 Scott Blk.

Also Sold By:

WESTERN SUPPLY AND EQUIPMENT COMPANY, Ltd.,

Edmonton Calgary Lethbridge

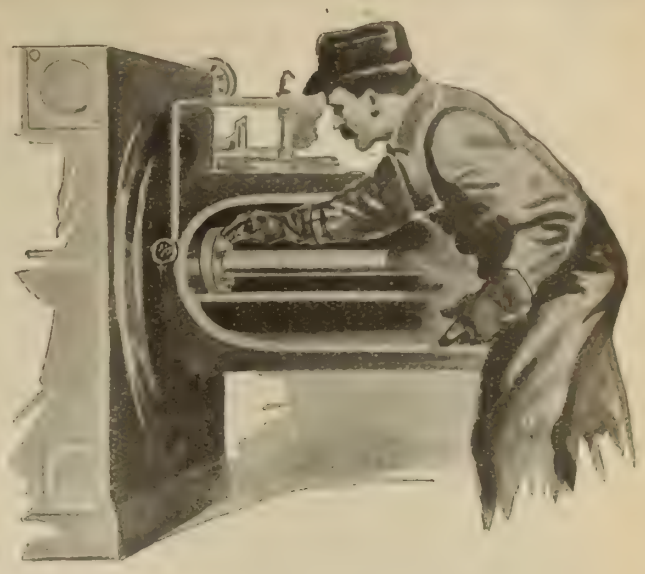
The advertiser would like to know where you saw his advertisement—tell him.

"I Just Use My Fingers"

Simply enough pressure to bring the packing snug to the rod is all that is required. Don't use a wrench.

The "sliding wedges" and "compressible cushion" are sensitive to every change in the steam pressure, and vary the bearing on the rod with the requirement.

P. P. P. holds steam-tight but causes no unnecessary friction.



DANIEL'S ROD PACKING **P. P. P.** COIL RING SPIRAL

"In explanation of the automatic working of Daniel's P. P. P. Packing, and the extraordinary results shown by the tests, it should be said that this packing is placed in the stuffing-box **loosely**, the gland set up to it gently, and secured by the gland bolts and nuts; then as the steam or other fluid strikes the cushion, the packing adjusts itself to the rod with a degree of tightness barely sufficient to prevent leaking, and in proportion to the varying pressure on the packing. By thus securing the necessary pressure of the packing on the rod **by the pressure from the cylinder**, we get an automatically adjusted pressure on the rod, which never exceeds the pressure from the cylinder at any point of the stroke."—Report of Mechanical Engineer.

A Bridgeport, Conn., chief engineer writes: "I have used P. P. P. on scored rods, and by just using my fingers to screw up the stuffing-boxes, they were made tight and stayed tight longer than with any other packing."

How to Get the "Slide Valve" FREE

Fill out the Coupon, and mail it to us. We will address a book to you, and send it FREE of charge.

Your Name .....

Address .....

Employed by .....

Address .....

Horsepower of Engine .....

Kind of Rod Packing Used .....

Do You Use **EBONITE** Sheet Packing? .....

Dealer's Name .....

Address .....

Name of Buyer .....

..... Series 24-F

Daniel's P. P. P. is the **original** self-setting rod packing. None but the genuine has ever been tested scientifically. Order enough to pack your engine one time — you'll use no other.

If your dealer does not keep P. P. P., write us, and we will see that you are supplied.

QUAKER CITY RUBBER COMPANY

Manufacturers of Mechanical Rubber Goods

PHILADELPHIA	CHICAGO	PITTSBURGH	NEW YORK
629 Market Street	182 W. Lake Street	207 Wood Street	207 Fulton Street

The advertiser would like to know where you saw his advertisement—tell him.

SERVICE

In that word is all that spells success in Business Building. No matter what you manufacture or sell, it is the Service you render that counts. This is remembered long after the price is forgotten.

Service is what you need in your power plant—not that service that just gets you through the day's work but S-E-R-V-I-C-E that spells plenty of reserve power. This is the service that makes the wheels hum—that keeps down the cost of upkeep—that puts ginger into the mechanism. This is only one of the many things a

Bowser Oil Filtering and Circulating System

will do for you. It is the last word in Service.

You know the necessity of using stream feed on your journals. You have read Kent, the greatest authority on this subject, and appreciate the possibility of saving 60% per horse power per year with stream feed.

But what you don't know how to find is a practical system that will enable you to do it—to re-use your oil—cut your horse power cost and still render 100% Service.

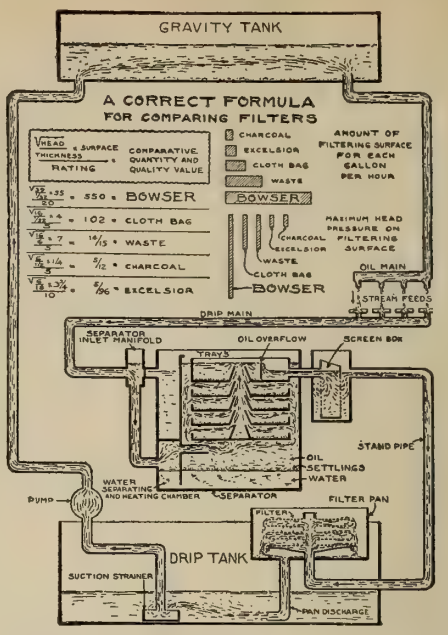


Illustration shows clearly the course the oil takes in circulating from bearing to filter and back again.

Note the distinguishing and exclusive features as described in the body of the advertisement. This is Service.

Necessity is the Mother of Invention

This is an oft repeated, time honored phrase—but none the less true. As machinery became more and more a necessity in the commercial and every day world, the question of lubrication became paramount. Without it not a wheel can turn. Sperm, lard and other animal oils were inadequate to meet the demand of the Eighteen Hour Special, automobile, Lusitania, etc.

Petroleum, a natural rock oil, was used at Babylon and Ninevah. It was burned in lamps in Sicily under the rule of the Romans. It was not, however, until 1853 that petroleum was suggested by Dr. Brewer of Pennsylvania (U.S.A.) for lubricating and illuminating purposes. He devised means of purifying the crude product. Col. E. L. Drake, of the same state, five years later, successfully produced commercially the first lot of crude petroleum.

Early in the 1880's, only twenty years after the recognized use of petroleum as a commercial necessity, Mr. S. F. Bowser of Fort Wayne, Ind. (U.S.A.), farsightedly saw the necessity of conserving this product. Being a nature-loving man he followed close upon Nature's lines and in 1885, just twenty-five years after the beginning of this vast industry, created the first self-measuring oil storage equipment. From that time to this, he and the company have steadily progressed until now they are recognized the world over as the oil storage and distributing experts.

Among the many wonderful inventions brought out by this company is the self-registering pipe line measure, which accurately delivers the liquid from the place you keep it to the spot you need it in the exact quantities you want, without the use of labor, containers, trucks, etc., by simply opening a valve. It is so simple a child can operate it, yet as durable and useful as a high grade clock.

Over a million users in every walk of life, from the factory and railroad president, manager and superintendent, storekeeper, public and private garage owner, dry cleaner, etc., today testify as to the need of their product. The company has kept pace, not only with the demand, but with the insurance requirements, building equipment to conform to that measure of safety prescribed by the National Board of Underwriters. Not only has this company kept pace with the production of oil, but has kept far in the lead for its conservation.

Study the Diagram

It will show you how the Bowser solves your problem. Note how it is possible to swathe the bearings in oil—almost eliminating friction—with not one drop wasted.

All the oil is collected at the bearings and returned to the system where it is filtered through

Three Distinct Processes

The Bowser doesn't depend upon filtration alone to cleanse the oil. With it the oil passes through a "forced" precipitation compartment, then through a fine screen compartment, and thence, under a high pressure head, to the close woven cloth filters which provide 3 sq. ft. of surface for each gallon of oil per hour to be filtered.

The Bowser Possesses These Exclusive Features

The pumps are automatically governed and the water is automatically ejected.

Continuous in operation.

Easily accessible for cleaning.

Less floor space proportionate to filtering surface.

Oil level automatically maintained

Inspected and cleaned without shutting down.

Sediment trays and screen arrangements remove heavier impurities permitting finer filtering material.

All tanks free from pressure.

Bowser Accessories

In addition to the complete system, we carry a complete line of oil fountains, oil cups and attachments, rocker arm joints, sight posts, oil headers, branch supports, blow-off caps, throttle extension, lubricator valves, drip manifolds, fill boxes, etc. These are sold separate from the system when so ordered.

Send for illustrated descriptive Book. It will give more details.—It's free.

S. F. Bowser & Co., Inc.

66-68 Frazer Avenue **TORONTO, ONT., CAN.**

Made by Canadian Workmen and Sold by Canadian Salesmen.

Sales Offices in all Centres and Representatives Everywhere.

Original patentees and manufacturers of standard, self-measuring, hand and power-driven pumps, large and small tanks, gasolene and oil storage and distributing systems, oil filtering and circulating systems, dry cleaner's systems, etc.

Established 1885.

Stop Blow-outs and Leaks in Pipe Lines by Using GOETZE No. 2 ELASTIC GASKETS

If you start right now to renew with No. 2 ELASTIC GASKETS, you can steadily reduce your renewals until you have brought them almost to the vanishing point.

This is not a mere "claim"—it is backed up by a *guarantee*—in fact the strongest guarantee ever made by a gasket manufacturer.

Think what it means to re-gasket a joint so it will *keep tight for years,* instead of days or weeks. Think of the saving resulting in gasket costs, labor and shut-downs.

What No. 2 Elastic Gaskets Will Do

No. 2 ELASTIC GASKETS will make the most troublesome joint you have absolutely tight — and keep it so. They "stay put" and stay tight. Prevent leaks, blow outs and shut-downs. Will practically eliminate renewal expense for gaskets.

No. 2 ELASTIC GASKETS are for high pressure and super-heated steam lines, but owing to their indestructible nature, are equally adapted to *any and every condition* about a factory, mill or refinery.

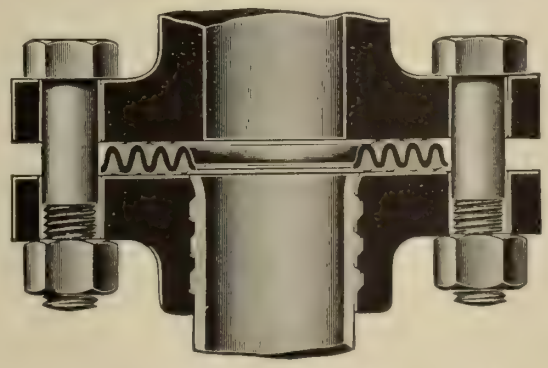
The No. 2 Elastic Guaranteed

Every No 2 Elastic Gasket is Guaranteed for 5 Years Continual Service in the Same Joint

There are no "ifs and ands" about this guarantee. It means just what it says. It applies to every No. 2 GASKET whether bought direct from us or through a dealer.

How No. 2 Elastic Gaskets are Made

These Gaskets are made of corrugated copper with asbestos lining No. 2. The corrugations allow for expansion and contraction of the pipes, while the asbestos, being forced into the



pores of the metals in the flanged surface by the "squeeze" and the constant pressure of the corrugations beneath it, holds securely against the highest pressures.

Goetze Gaskets are carried in stock by

T. McAVITY & SONS, LIMITED

ST. JOHN, N.B.

BRANCHES AT

MONTREAL
112 St. Peter Street

WINNIPEG
C. E. Chown, 147 Bannatyne Street

VANCOUVER
c/o A. O. Campbell, 1069 Ham

MANUFACTURED BY

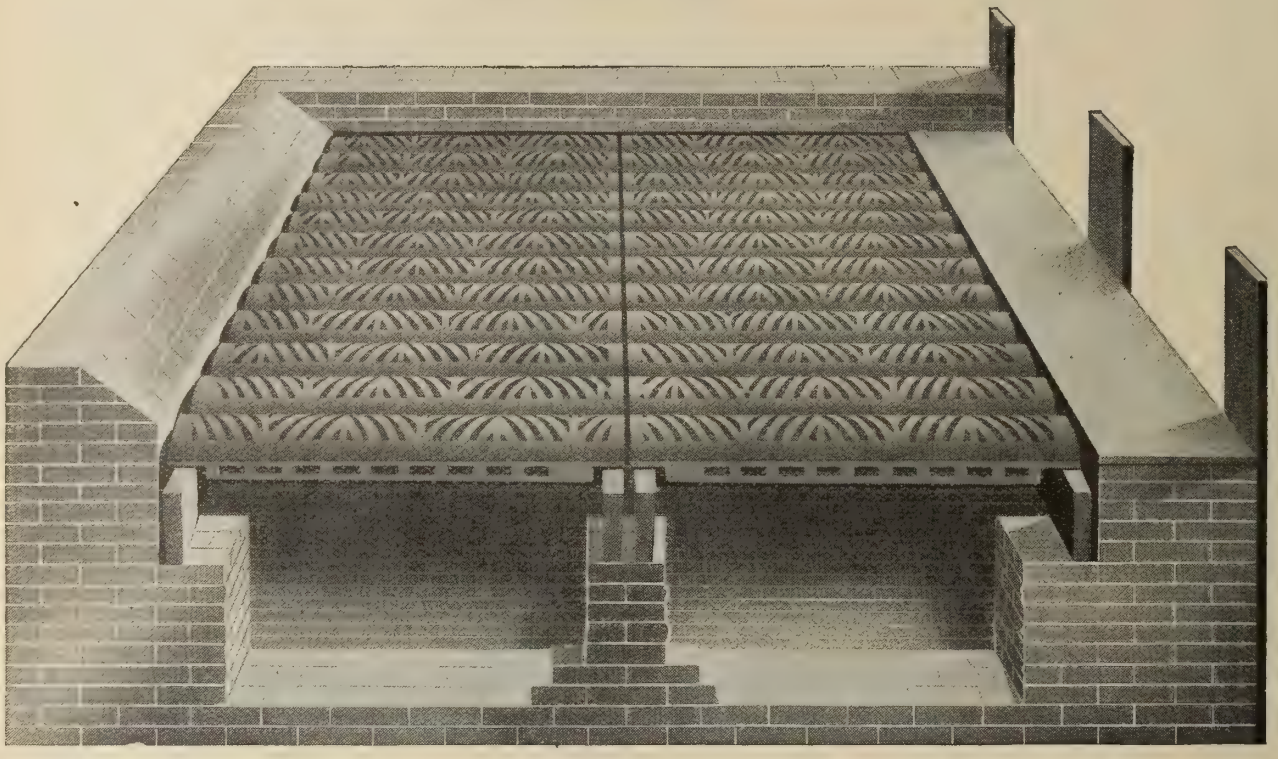
Goetze Gasket & Packing Co., New Brunswick, N.J.

The advertiser would like to know where you saw his advertisement—tell him.

THOMAS ELLIPTIC GRATE BARS

SHAKING—CIRCLE—STATIONARY

FOR EVERY FUEL



THOMAS IDEAS

PATENTED

THOMAS ELLIPTIC GRATE BARS	INCREASE STEAM—SAVE FUEL—SAVE LABOR —COST LESS—REDUCE SMOKE.
THOMAS GRATE RESTS	EVERLASTING—PRESERVE GRATE BARS—PROTECT FIRE WALLS.
THOMAS FURNACE SETTING	FIRE WALLS—BRIDGE WALL—FRONT WALL independent of all expanding and contracting irons. SEE THAT AIR SPACE COMPLETELY ENCIRCLING THE GRATE AREA. No dead and burned grate bar ends. No pushed down walls from expansion of grates.

Shipped from Hamilton, Ont. **Let us give you complete information.**

FOR ALL PROBLEMS

Steam—Grate Bar—Furnace—write THOMAS

The General Supply Co. of Canada, Ltd.

OTTAWA TORONTO WINNIPEG

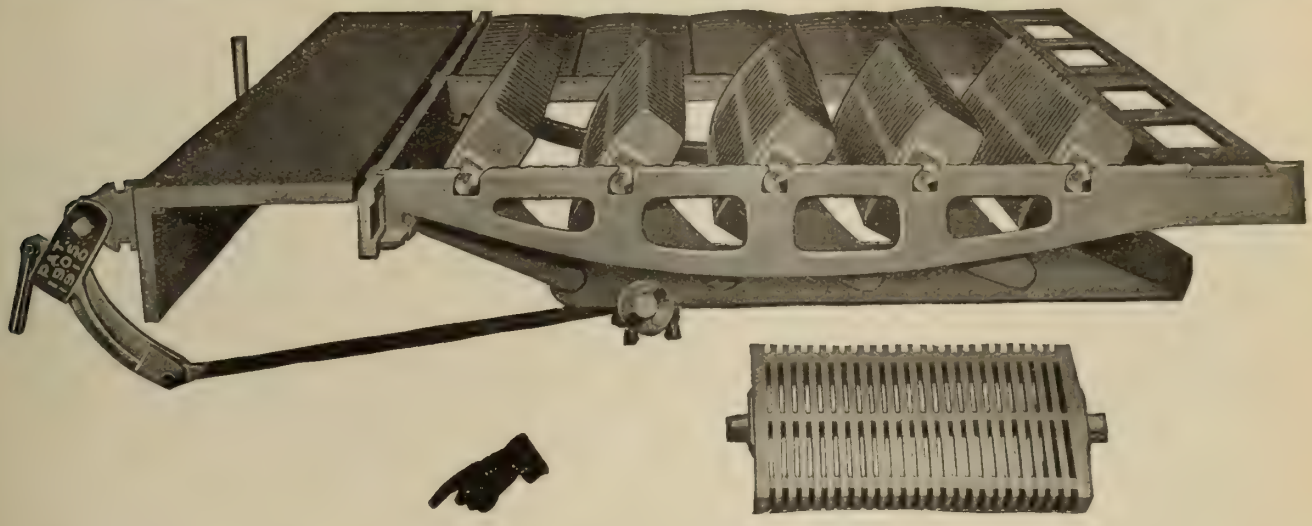
THOMAS GRATE BAR CO., **Birmingham, Ala., U.S.A.**

"THE Cyclone"

Shaking and Dumping Grate Bar

Generates More Steam From Less Fuel Than Any Other Grate Bar

Burns the Cheapest Grades of Fuel with Results Equal to that of the Best.



The improved shaking mechanism means more vigorous and effective shaking and prevents any ashes or clinkers from clinging to the centre of the grate.

This Grate Bar has been on the market for years and has been endorsed by all users as the best they have ever used.

The **"Cyclone"** is the one Grate Bar that locks level and cannot get out of adjustment or become warped.

The **"Cyclone" has many imitators but no equals. Be sure you get the genuine.**

We will be pleased to furnish you with names of some users so that you can write them and find out how they like the **"Cyclone."**

The construction of the **"Cyclone"** allows 68 per cent. air space and 90 per cent. Under Draft — this assures practically perfect combustion.

WRITE US TO-DAY

The Canadian Steam Boiler Equipment Co., Limited

SOLE MANUFACTURERS FOR CANADA

211 QUEEN STREET EAST :-: :-: :-: **TORONTO, CANADA**

AGENTS

ST. JOHN, N.B., F. W. Blizard, Canada Permanent Chambers. MONTREAL, H. L. Peiler & Co., 308 St. James Street.
HAMILTON, Robt. Fitzsimmons, 8 Grove Street. CALGARY, Alta., The Western Foundry & Metal Co., Limited.
BERLIN, J. Hainsworth, 14 Foundry Street. WINNIPEG, Vulcan Iron Works.

Proper Draft in the Furnaces, Flues, Etc.

is an important factor in the attainment of Economy and Efficiency in the Boiler Room.

The "Redline" Differential Draft Gauge

illustrated here, is our latest and most superior type of Draft Gauge for measuring draft and extreme low pressures.

Furnished in two styles — with and without micrometer leveling attachment.

Made with closed front protecting the glass parts against breakage and the collecting of dust.

The liquid employed is a mineral oil, colored a deep red, greatly facilitating readings.

Write NOW for Pamphlet W127

The Schaeffer & Budenberg Mfg. Co.

Chicago Washington **BROOKLYN, N. Y.** Pittsburgh New Orleans

(125)

THE VULCAN IMPS

I SAVE LABOR
SO DO I
I CLEAN TUBES EVERY FEW HOURS
I CLEAN TUBES 100%
I INCREASE BOILER CAPACITY
I LIKE TO PLAY WITH MY COMPETITORS
I BLOW WITH THE DRAFT
I SAVE HOSE

"And We All Save Coal"

Wherever the **VULCAN SOOT CLEANER IMPS** are allowed to work they raise the Devil—the Soot Devil. They juggle the heat units and make two units grow where one unit grew before. They make slow steaming boilers "pop" for the first time in years. They give many a weary engineer and fireman a chance to rest. The IMPS are always on the job, "they work while you sleep." They cut out lost time, trouble and repairs. They are good for the operating man and mighty good for the boiler owner. Don't let Soot, the expense maker, worry you longer. Fill out the coupon, mail it now, and we'll send you our Free Booklet, "Economical Steam Production," which shows how the Vulcan removes Soot, and saves from 5 to 15% in fuel.

Mail the Coupon

Vulcan Tube Cleaning Systems, LIMITED

42 Craig St. West **MONTREAL**

SIGN, TEAR OUT AND MAIL

P.H. 10-12. Date.....

VULCAN TUBE CLEANING SYSTEMS, LIMITED, Montreal.

Please send me, without charge, your book—ECONOMICAL STEAM PRODUCTION, and your proposition.

(It is important that following information be given in full.)

WATER TUBE BOILERS. Number.....Type.....
Pressure .....Horsepower .....No. Tubes H
(except on Stirling boiler .....Any Superheaters .....Width of alley space at side .....
TUBULAR BOILERS. Number.....Horizontal or Vertical .....
Name .....
Address .....

The advertiser would like to know where you saw his advertisement—tell him.

JENKINS BROS.'

TRADE JENKINS MARK

Jenkins Bros.

EXTRA HEAVY IRON BODY VALVES

We manufacture a full line of valves, designed for 250 pounds working steam pressure. The valves are handsomely designed, are made of the highest grade metal and are unsurpassed in workmanship. Realizing their importance, no effort has been spared to make the entire line representative high pressure valves. The spindles are large and have powerful threads. The stuffing boxes are large, allowing plenty of room for packing, which is easily accessible and the valves can be re-packed while under full pressure and wide open. These valves are practically indestructible, inasmuch as all parts subjected to wear can easily be renewed, without necessitating the removal of the valve from the pipe line. Insist on securing the "Genuine Diamond Brand JENKINS BROS.' VALVES."

CATALOG WILL BE SENT UPON REQUEST.

103 St. Remi St. JENKINS BROS., LIMITED, MONTREAL

The advertiser would like to know where you saw his advertisement—tell him.

The Murphy Automatic Smokeless Furnace

The **Murphy Iron Works** recently completed the **third installation** for the CANADIAN LOCOMOTIVE WORKS, Kingston, Ont.—in seven years: a total of 6 furnaces, 1623 H.P.

Is now installing "third order" for the HARRIS ABATTOIR COMPANY, Toronto, Ont.—after four years' experience with first installation; now have six furnaces, 1650 H.P.

Is installing four furnaces for ONTARIO PAPER COMPANY, Thorold, Ont., 1332 H.P.

Is installing two furnaces second contract Spanish River Pulp & Paper Company, Espanola, Ont., making a total of six furnaces, seventeen hundred and twenty Horse Power.

There **"Must be a reason"** for the repeat orders.

For printed matter write:

MURPHY IRON WORKS, DETROIT, MICH. BUFFALO, N. Y.

"THERE is a principle which is a bar against all progress, which is proof against all argument and cannot fail to keep a man in everlasting ignorance. This principle is unreasoning prejudice against full investigation."

WHY NOT INVESTIGATE THE

FULTON WATER-COOLED MECHANICAL STOKER

OTHERS HAVE DONE SO AND HENCE

4,000 HORSE-POWER SOLD

AND INSTALLED IN CANADA IN 1913

Manufactured by

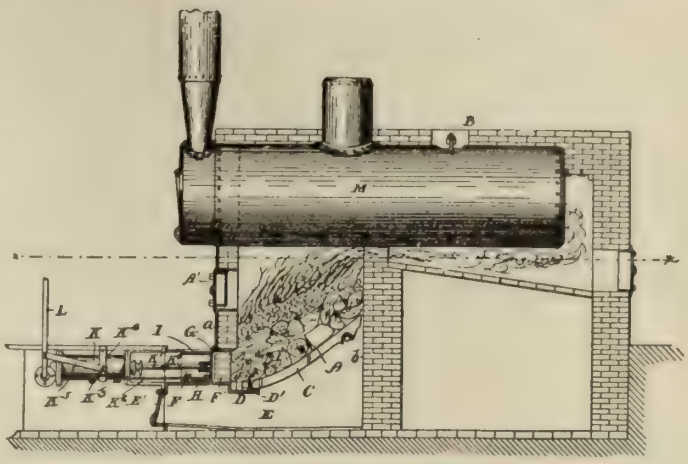
The HARE ENGINEERING COMPANY, Ltd.

14-16 King Street East **TORONTO**

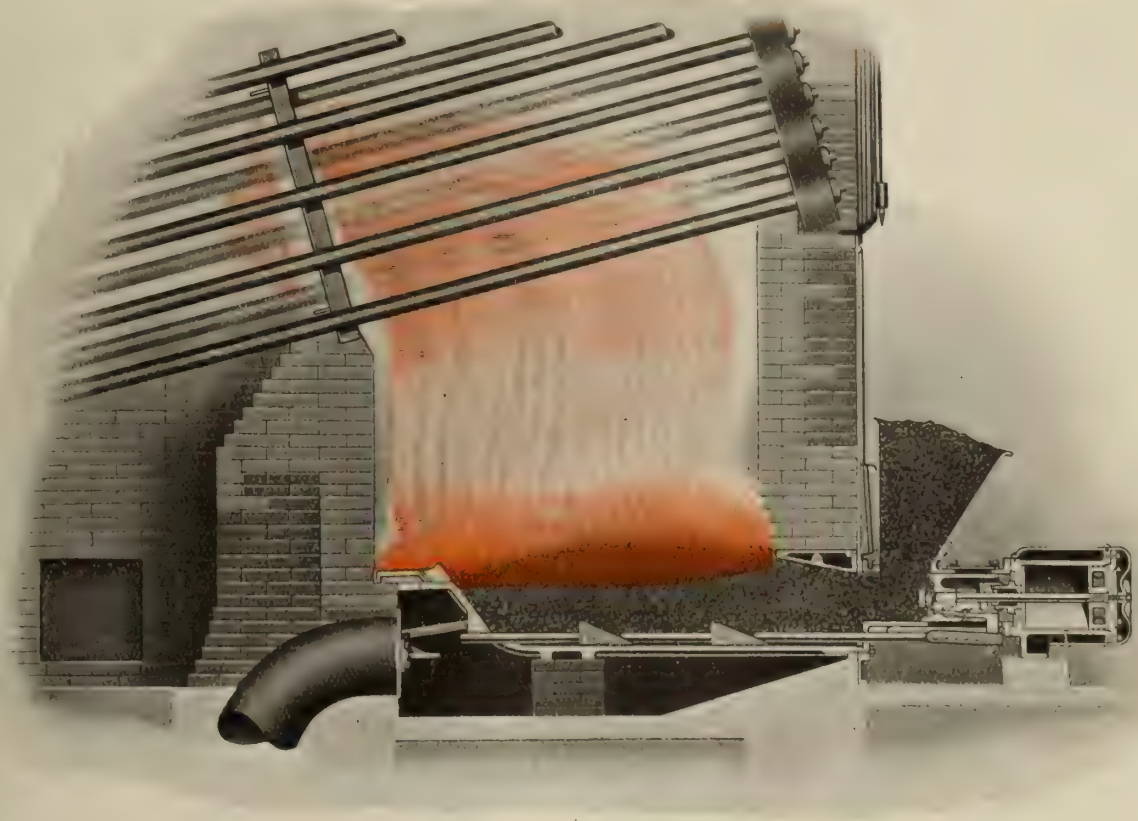
The advertiser would like to know where you saw his advertisement—tell him.

"THE CRYSTALLIZATION OF AN IDEA"

Fittingly expresses the process of gradual evolution through which the JONES STOKER has passed since the time it was designed by its inventor for the purpose of burning wood, to its coal burning form of the present day. From the very outset the JONES STOKER has won its way by merit, because the underlying basic principle in that idea was RIGHT; and, though that conception found its expression originally in the mechanically crude form common to the history of all great inventions, time and skilled engineering experience have again contributed to fuse and to weld together those elements which, united in their homogeneous whole, form that gem, "SUCCESS."



THE FIRST JONES UNDERFEED STOKER



THE MODERN JONES UNDERFEED STOKER

——WITHOUT EXCEPTION FURNISHES TO-DAY——

THE MOST EFFICIENT SYSTEM OF BURNING BITUMINOUS COAL!

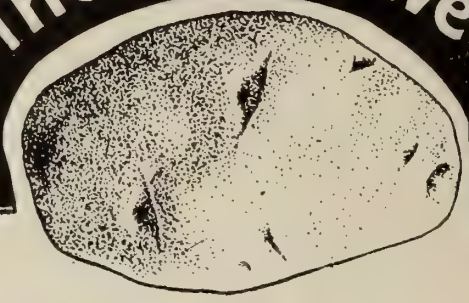
THE JONES UNDERFEED STOKER CO., LIMITED

NATIONAL TRUST BLDG. - - - - TORONTO

The advertiser would like to know where you saw his advertisement—tell him.

POTATO SCALE

The Effective BOILER CLEANSER



A Simple Scale Remover that contains no Chemicals that will injure the Boiler, Tubes or Fittings.

It will save you many dollars a year.

Send us a gallon of your Feed Water and we will mix a quantity for FREE TRIAL to Suit your Feed Water Conditions.

Write To-Day.

When on the market for High Grade OILS Be sure to get our

Numidian Cylinder
Velox Engine and
Sliptivity Machine Oils
They're Hard To Beat

C. C. SNOWDON

Refiner, Importer and Manufacturer of

PENNSYLVANIA LUBRICATING AND REFINED OILS, GASOLINE, POTATO SCALE POWDER, LIQUID SOAP, DISINFCTANTS, POLISH, WASTE, OIL TANKS, Etc.

1810-1840 11th STREET EAST, CALGARY, ALBERTA

P.O. Box 1384

DART

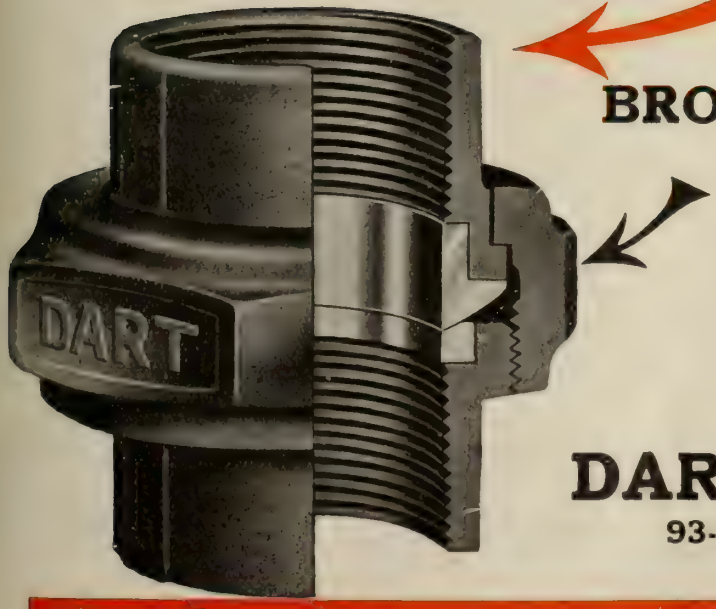
UNION PIPE COUPLINGS

Cannot
Leak, Rust or Corrode

Make Joints Easily and Quickly
Whether Pipes are in or out of Line

Can be Connected and Disconnected
Time After Time Without Impair-
ing Their Efficiency

Expansion or Vibration



BRONZE to BRONZE at the Joint

Our trade mark is cast on every Dart Union, any found defective will be replaced with two new ones.

Your jobber sells Dart Unions.

DART UNION CO., Limited
93-97 Niagara Street, TORONTO, ONT.

The advertiser would like to know where you saw his advertisement—tell him.

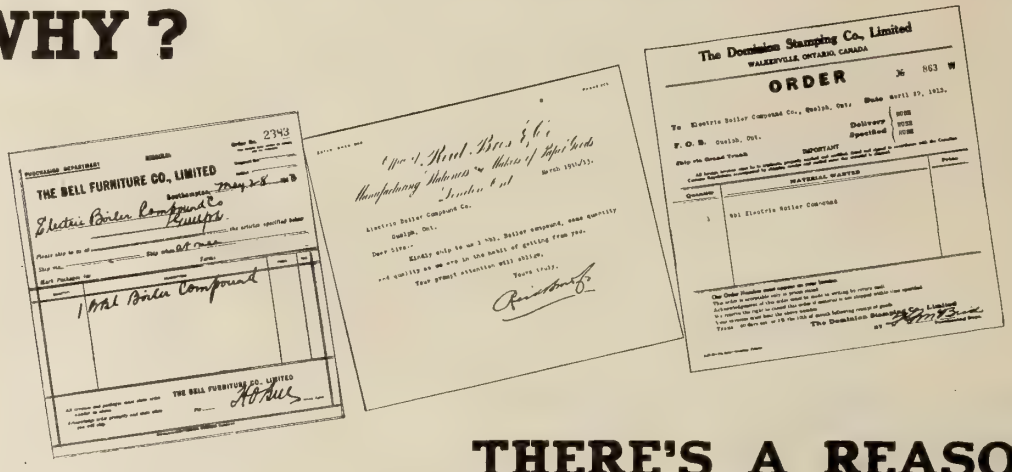
It Will Cost You Less

To Keep Your Boilers Free From Scale and Prevent Foaming, Pitting, Etc., If You Use

WALKER'S ELECTRIC BOILER COMPOUND

It Saves Fuel and Increases Boiler Efficiency

WHY ?



THERE'S A REASON

We Also Manufacture These High Grade Oils:

REGAL VALVE OIL
RED STAR CYLINDER OIL
MONARCH CYLINDER OIL
HEAVY RED MACHINE OIL
SUPERIOR ENGINE OIL
ELECTRIC ENGINE OIL
BRUSH DYNAMO OIL
ANTI-CARBON AUTO OIL
PURE TRI-SODIUM PHOSPHATE

The Electric Boiler Compound Co., Ltd.
Guelph, Ont.

The advertiser would like to know where you saw his advertisement—tell him.

Three Hundred Boilers And Sixteen Locomotives Owned By A Michigan Copper Mining Company Are Kept Absolutely Scale Free And Scale Proof

Mr. Engineer: There is one real, efficient remedy for all boiler troubles. A remedy ABSOLUTELY GUARANTEED. It is not a new remedy. It is not an experiment. No guess work, but an accomplished success. Perolin has been used throughout entire Europe for the past 18 years, with universal success, under the name "D. R. DAMPF-KESSEL-MISCHUNG."

Three years ago we secured the same German formula that had proven such a big success in Europe, and in that short three years have secured and held over 10,000 of the largest and most up-to-date plants in the United States.
Never mind how bad your scale conditions are. Forget the other so-called remedies you have tried. Be skeptical if you will, but have an open mind. Give us a chance to prove to you that we can absolutely cure all your boiler troubles, and keep them cured.

Perolin

from Germany

Our Guarantee

Perolin German Boiler Metal Treatment is Guaranteed

1. To remove scale already formed in your boilers.
2. To prevent new scale from forming.
3. To stop all pitting, corroding and galvanic action.
4. Not to corrode or injure the boiler metal or packing.
5. Not to affect or impart any off-odor to steam generated from the water.
6. To correct oil troubles, caused by oil or grease getting into boiler water.
7. Not to affect the products of Breweries, Ice Plants, Creameries, Dye Works or any product where live steam is used in the manufacture of their goods.
8. That it does not affect the water, neither is it affected by the water and that the Perolin Preservative Film is a good transmitter of heat.

How Perolin Acts Mechanically.

Perolin is not a "Boiler Compound" in the generally accepted meaning of the term—because it has no chemical action whatever upon the water or scale. Perolin is a metal treatment, and when introduced into the boiler is drawn to the metal and mechanically breaks the bond of adhesion between the scale and the metal. It then establishes a "Perolin Preservative Film" on the metal which has a high conductivity of heat and this Perolin Film repels all precipitated scale forming sediments, preventing any further scale formation. This sediment is removed each day through the blow-off pipe.

Perolin does not treat the water. The water is always changing—so there is nothing definite about that—Perolin treats the boiler metal—it is everywhere and always the same.

PEROLIN THE CHEAPEST.

Not by the pound, but by the month. Are you keeping your 100 H.P. boiler absolutely clean for 5c per 12-hour day?—We can do this for you with Perolin after the boiler is once cleaned.

FIRST YEAR COST TO MECHANICALLY BREAK DOWN SCALE IN BOILER AND ESTABLISH A PEROLIN FILM ON SAME.
BASIS 100 H.P., 12 HOUR RUN.

12-hour dose	For	Run	Quantity used	
1 quart	60 days	1st run	60 quarts	23.40
1 pint	30 "	2nd "	15 "	5.85
½ "	30 "	3rd "	7½ "	2.95
¼ "	180 "	4th "	22½ "	9.00
	300 days	Full working year	105 quarts	$41.20

SECOND AND SUCCEEDING YEARS.

12-hour dose	For	Run	Quantity used	Cost.
¼ pint	300 days	Year	75 pints	(SAVE) $15.00

We want you to try Perolin—Write to-day for our "Information Sheet" upon which give us full information about your boilers—Upon receipt of this information we will ship you freight Prepaid a sufficient quantity of Perolin to make a 60-day test in your plant. If at the end of the 60-day test you are not more than pleased—bung up the barrel and return it to us and we will cancel all charges against you—Could anything be fairer?

If you would like further Perolin information we issue a valuable little booklet entitled "It doesn't affect the Water,' which will be sent to you free upon request. Ask for it.

Perolin Company of Canada, Limited

STANDARD BANK BUILDING, TORONTO, ONT.

Sole Distributors For The Dominion

CANADIAN GENERAL ELECTRIC CO, LIMITED.

HEAD OFFICE, TORONTO.

MAIN ELECTRIC WORKS, PETERBORO.

NO 1. POWER HOUSE, PETERBORO.

NO 2. POWER HOUSE, PETERBORO.

ELECTRICAL SUPPLY WORKS, TORONTO.

ELECTRIC PORCELAIN WORKS, PETERBORO.

DISTRICT OFFICES

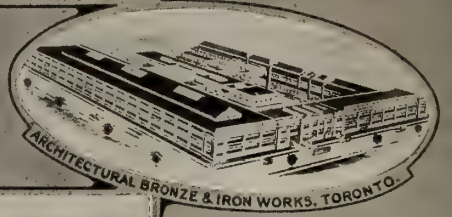
MONTREAL, QUE.
HALIFAX, N.S.
OTTAWA, ONT.
COBALT, ONT.

CANADIAN ALLIS-CHALMERS, LIMITED. TORONTO WORKS.

DISTRICT OFFICES

EDMONTON, ALTA.
REGINA, ASSA.
SASKATOON, SASK.
NELSON, B.C.

BRIDGE WORKS, BRIDGEBURG.



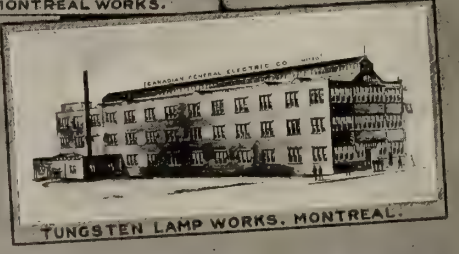
ARCHITECTURAL BRONZE & IRON WORKS, TORONTO.

PORCUPINE, ONT.
WINNIPEG, MAN.
CALGARY, ALTA.

CANADIAN ALLIS-CHALMERS, LIMITED. MONTREAL WORKS.

VICTORIA, B.C.
VANCOUVER, B.C.
PR. RUPERT, B.C.

CARBON & TUNGSTEN LAMP WORKS, TORONTO.



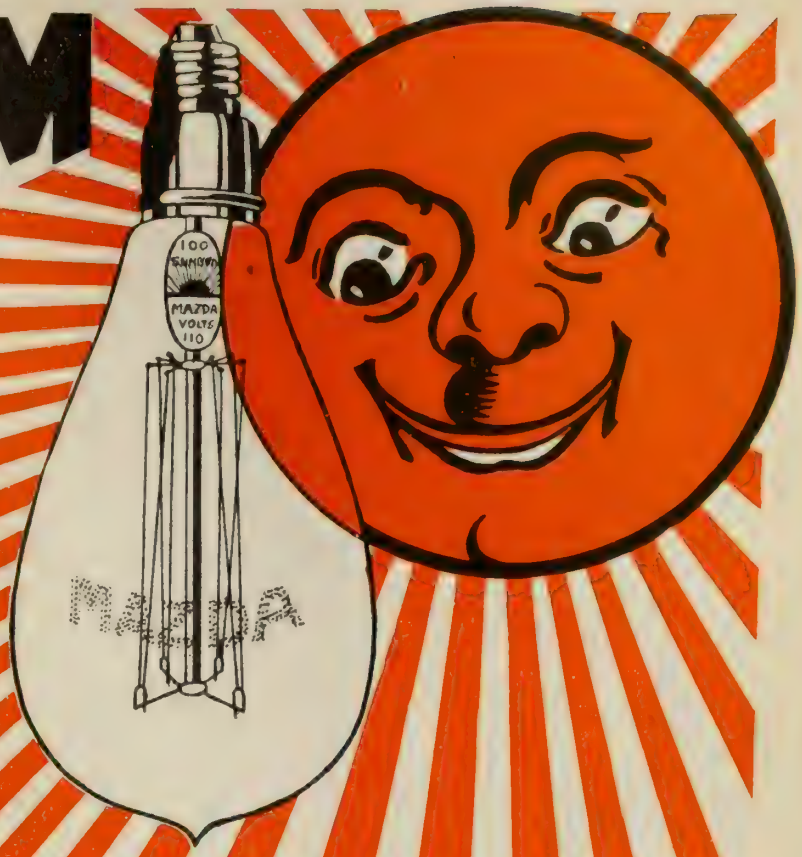
TUNGSTEN LAMP WORKS, MONTREAL.

CANADIAN ALLIS-CHALMERS, LIMITED.

The advertiser would like to know where you saw his advertisement—tell him.

SUNBEAM

MAZDA
DRAWN WIRE
TUNGSTEN LAMPS



Will Give Your Plant 3 Times as Much Light As Carbon Lamps For The Same Current Consumption

"Sunbeam" Mazda Lamps will make your plant as light as day, and will enable your workmen to increase the quantity and quality of your production.

A plant that is improperly lighted loses money. The work **cannot** be up to the mark as the **employees** are seriously handicapped.

"Sunbeam" Mazda Tungsten Lamps are of a quality that assures a long efficient service.

Try the "Sunbeam" Lamps now. We ship promptly.

The Canadian Sunbeam Lamp Co., Ltd.

Main Office and Factory: TORONTO.

Branch Warehouses: Montreal, Winnipeg, Calgary, Vancouver.

NEWTYPE BERGMANN LAMPS

(Tungsten Filament)

THE UNBREAKABLE KIND

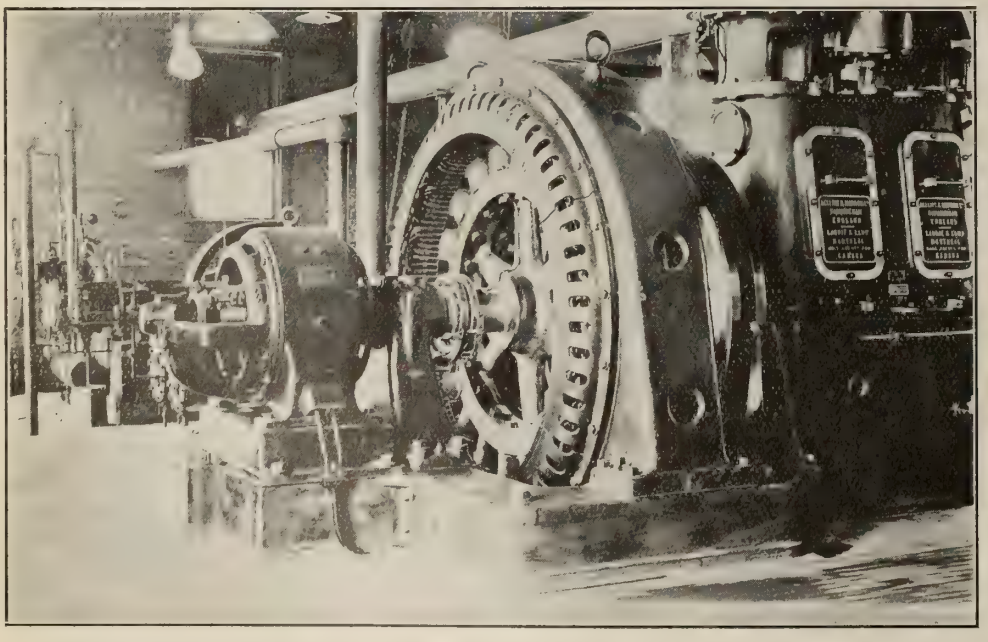
Are now ready for delivery. We guarantee delivery to you in good condition.

EXCLUSIVE CANADIAN DISTRIBUTOR:

P. H. KLEIN CO., Limited

Live Agents wanted all over Canada. **329 Craig Street West** **MONTREAL**

High Class Swedish Electrical Equipment



Owing to liberal design and the use of the best grade of Swedish Steel and Iron, we are able to guarantee and obtain the very best results.

350 K.V.A. 2200 Volt, 2 Phase, 60 Cycle, 360 R.P.M., AC. Generator connected to Bellis & Morcom High Speed Engine, supplied to Corporation of Wetaskiwin, Alta.

KILMER, PULLEN & BURNHAM, Limited

Head Office : TORONTO **Branch Office : MONTREAL**

Whether You Are Breaking 5 amps or 10,000 amps—

you will find that

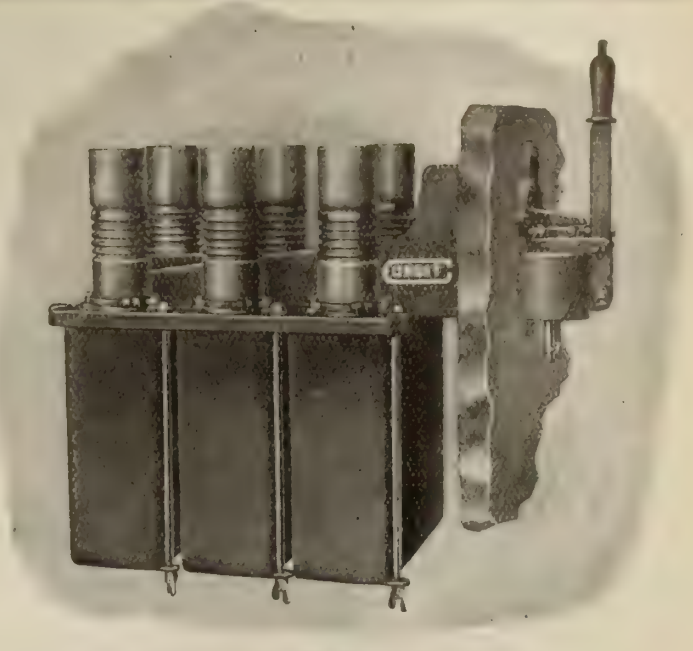
Condit Switches and Circuit Breakers

give absolute satisfaction.

Condit Switches and Circuit Breakers are not designed to open the circuit, but to **keep the circuit closed,** except in cases where an open circuit is necessary to protect valuable apparatus.

A special laminated brush gives Condit Circuit Breakers a wiping and self-cleaning action. This is a feature possessed by no other circuit breaker.

Furnished to meet any specifications up to 15,000 volts.



Conduit Circuit Breaker, Type D. F.
Write our nearest house for full information.
Exclusive Agents for Canada:

THE Northern Electric
AND MANUFACTURING CO. LIMITED

Montreal Halifax Toronto Winnipeg
Regina Calgary Edmonton Vancouver

ADANAC RED CORE RUBBER COVERED WIRES AND CABLES

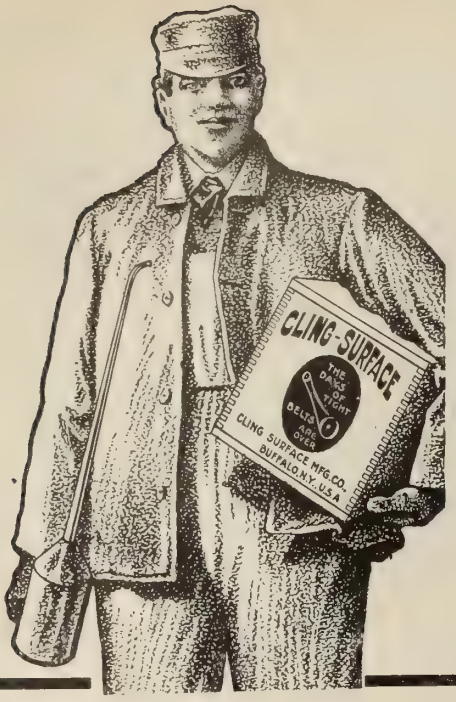
Are made according to the specifications of the National Board of Fire Underwriters. The conductors are drawn from copper of the highest conductivity and are covered with two thicknesses of thoroughly vulcanized rubber compound of high quality. The wires are braided over insulation and the smooth high finish they receive makes them specially desirable for conduit work.

IMPERIAL WIRE AND CABLE COMPANY

Limited
MONTREAL

THE Northern Electric
AND MANUFACTURING CO. LIMITED
Sales Agents

TORONTO REGINA WINNIPEG
CALGARY EDMONTON VANCOUVER



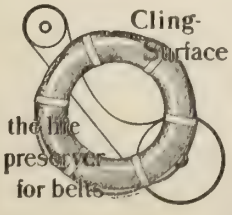
"The factory man that doesn't have belt troubles simply beats the trouble bird to his belts and keeps them in order."

That's what Mr. Chase, our New York manager, says, and he has had as much or more belt experience than any man we know. Surely his idea is logical.

You wouldn't patronize a railroad that invariably waited for a wreck before repairing its tracks. You wouldn't wait for your boiler to explode before cleaning out the scale, yet when it comes to belts, that is about what many do—wait 'til a belt slips, runs off or breaks before giving it a thought.

As a good engineer or factory man, you can't possibly sanction such carelessness when systematic Cling-Surface treatment, at an insignificant cost, not only stops cracking, chafing and burning of the belt surface, but waterproofs and lubricates every inside and outside belt fiber, permits slack or easy running without slip, keeps the belt in prime vigor, and able to maintain high transmission efficiency throughout the longest possible life. If Cling-Surface did nothing else, its cost would be repaid a hundred fold in lessened belt bills, supplies and attention, and reduced number of accidental shut-downs during rush hours.

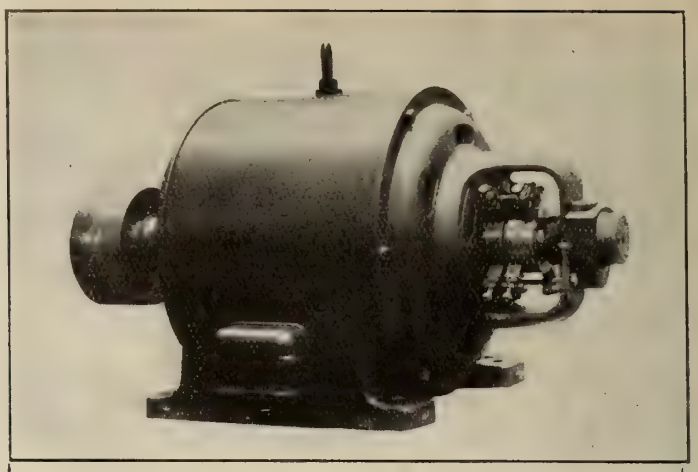
We'll gladly refer you to any number of prominent engineers in Canada who insist that successful and economic belt operations demand Cling-Surface. Our liberal guarantee enables you to make the trial without risk. We quote f.o.b. Toronto.



Cling-Surface Co

1057 Niagara Street
Buffalo N Y

67



A. C. Generator, Bracket Type with Exciter

POWER PLANTS, ROLLING MILLS, MINING, HOISTING MACHINERY

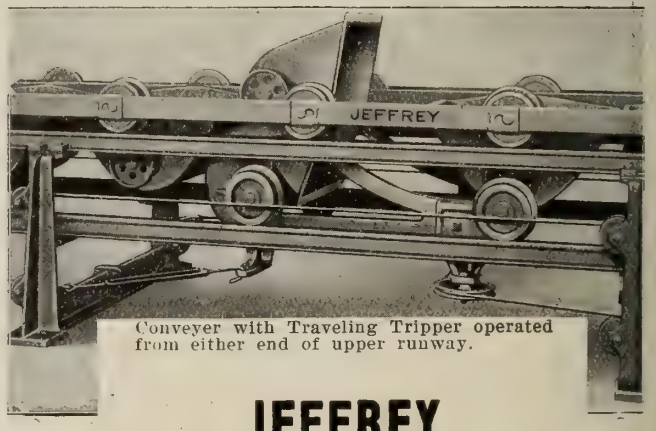
ELEVATORS PATENT "STIGLER"

Builders under patents of "STE. ALSACIENNE"

Belfort (France) Mulhouse Grafenstaden (Germany)

Engineering Works of Canada

MONTREAL, Quebec



Conveyer with Traveling Tripper operated from either end of upper runway.

JEFFREY
Pivoted Bucket Conveyers

insure a practical economical and labor-saving method of handling coal and ashes.

Our **Standard** Equipments are adapted to plants of all sizes.

Catalog 32-A tells about the service of over 50 coal and ashes handling systems we have installed in power plants. It's yours for the asking.

JEFFREY MFG. COMPANY

Canadian Main Office and Works, MONTREAL

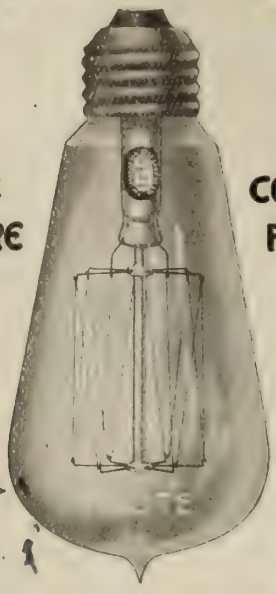
Winnipeg Representatives, N. J. DINNEN & CO.

The advertiser would like to know where you saw his advertisement—tell him.

"NULITE"

TUNGSTEN LAMP

GENUINE DRAWN WIRE



CONTINUOUS FILAMENT

Why continue experimenting with Tungsten Lamps?

Order "NULITE" the Best

"NULITE" A Canadian Product Manufactured by

The Canadian Tungsten Lamp Co., Ltd. HAMILTON ONTARIO

Branch Warehouses at: Montreal—246 Craig St. W. Winnipeg—56 Albert St. Vancouver—365 Water St.

Agencies: T. McAvity & Sons, St. John, N.B. Farquhar Bros., Ltd., Halifax, N.S. Mechanics' Supply Co., Quebec, Que. Dominion Illuminating Co., Ltd., Toronto, Ont.

Use Stephenson Bar Belt Dressing

Make 1913 a record breaking year. Turn over a new leaf and get rid of the things that have been causing needless trouble and expense. Adopt the things which will make your work easier, give better results and save money for your employer. You cannot start at a better place than with your belt dressing.

Get rid of your troublesome liquid dressing. Shake the can for the Stephenson solid stick and shake trouble at the same time.

Stephenson Bar Belt Dressing is a friend in need. It doesn't require preparation, nor do you have to use special care in applying it. The minute the belt slips you hold the Stephenson bar to the belt for a few seconds and the slipping stops. There's no waste—no slop—no smearing on of paste or pouring on of spattering liquid. And the results are better.

I'll **"Stick to the Solid Stick"**

Start With a Free ½ Lb. Sample

Simply send us your name and address and we ll send you a present in the shape of a free half-pound sample of Stephenson Bar Belt Dressing.

Remember—we give you this sample absolutely free of charge. Get this free half-pound of the finest belt dressing made and test it. Here's your chance to try somesomething really good at no expense.

None Genuine Without Trade-Mark

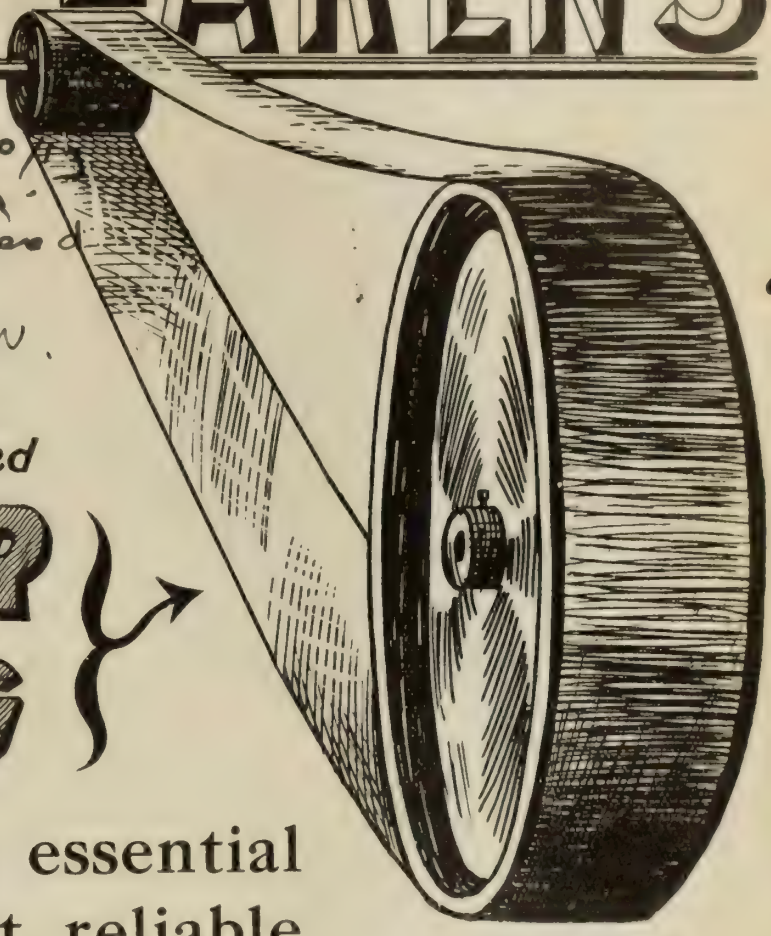
Stephenson Manufacturing Company

Est. 1888 Albany, N.Y. **Inc. 1897**

The advertiser would like to know where you saw his advertisement—tell him.

D. K. McLAREN'S

June 30
8 Cuts
Delivered
Boy
W. W.



Genuine British-Oak Tanned

LEATHER BELTING

has all the qualities essential to make it efficient, reliable and economical.

We personally supervise the selection of hides and the complete manufacturing process.

We see that the belt is thoroughly stretched before it goes on the market, so that the buyer will lose practically no time in tightening.

D. K. McLaren's Belting is worthy of your thorough investigation. It is a belting that is saving trouble and expense in many of the largest plants in Canada.

Our Trade Mark is put on every piece of belting we sell. It is a guarantee of perfectly satisfactory service.

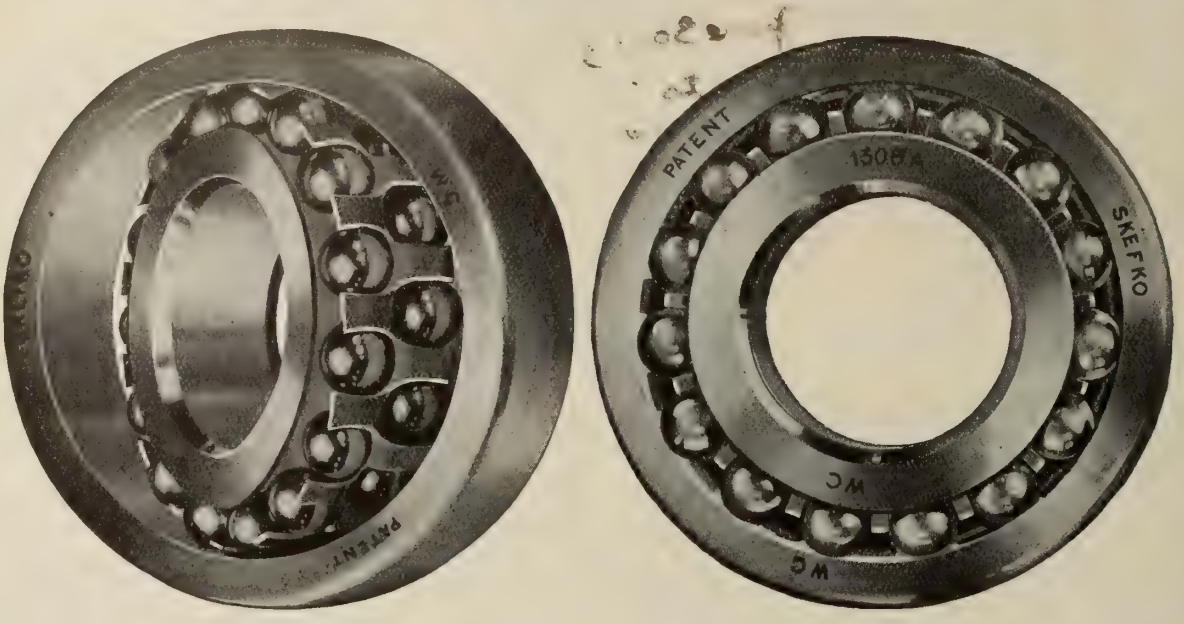
We will be pleased to get you in touch with some users of this belting — they will tell you about its service-giving qualities. Profit by their experience.

Write To-day.

D. K. McLaren, Limited

Montreal 351 St. James St. | **Toronto** 200 King St. W. | **Vancouver** 37 Alexander St. | **St. John, N B.** 64 Prince William St.

No User of Ball Bearings Can Afford to Neglect these Points



1. **Double Row of Balls**—virtually two bearings in one, a splendid feature under any load condition.
2. **Pressed Retainer in One Piece**—made from Swedish Lancashire Iron. No rivets, wires or screws to work loose, jam balls, disarrange spacing or make noise.
3. **Outer Race Spherical**—providing for a frictionless self-alignment that absolutely and automatically compensates for shaft spring.
4. **Best Swedish Crucible Steel**—Carefully heat-treated and uniform in hardness throughout. Unequalled for toughness, carrying capacity, accuracy and durability.

SKEFKO

is the only truly self-aligning bearing. This feature alone is worth most careful consideration.

¶ SKEFKO Self-Aligning Double Row, Double-Capacity, Double-Life Ball Bearings cost no more and are made in international standard sizes. Their use is practical under any speed and load condition and the lubrication and protective housing can be made to conform to any service requirements.

¶ SKEFKO Bearings are the recognized standard and are replacing other constructions in many types of machinery.

¶ Our literature explains these matters in detail. Your best interests demand that you investigate. Tell us your bearing troubles and ask for our bulletins.

SALES AGENTS

The Canadian Fairbanks-Morse Co.
Limited

ST. JOHN QUEBEC MONTREAL OTTAWA TORONTO
WINNIPEG SASKATOON CALGARY VANCOUVER

Neptune

Waterproof LEATHER BELTING

Will Revolutionize Your Cost Of Power Transmission

In places where the ordinary belt goes all to pieces **"Neptune" Belting** runs right along day after day every joint and every lap as tight and secure as when first put on.

"Neptune" Belting has been run out of doors exposed to rain, snow, and sun—it has been wholly submerged in water for hours at a time—frozen solid in ice—and exposed to scores of adverse conditions—it has stood the test every time—the laps will not loosen nor if double belting is used will the belting come apart between the plies.

Neptune is sold under a positive guarantee which protects you absolutely—a guarantee of perfect satisfaction.

Why not try out a **Neptune** in your plant, and let it prove its special characteristics, and assist you in solving your belting problems?

Send for copy of our Neptune Book—its 24 pages are of vital interest to every belting user. Write to-day.

This FREE 40 Page Book "Care of Belting" will tell you how to get the most service from your belts—tells how to repair laps of leather belting—tells how to cover iron pulleys with leather and many other things that will be of interest to every belt user.

THE

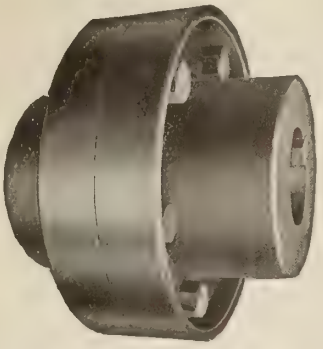
Graton & Knight Mfg. Co.

Worcester, Mass., U.S.A.

Kansas City, Mo.,	Atlanta,	New York,
Philadelphia,	Chicago,	St. Louis,
Pittsburgh,	Detroit,	Seattle,
Cleveland,	Milwaukee,	Minneapolis,
Portland, Ore.,	Boston,	San Francisco.

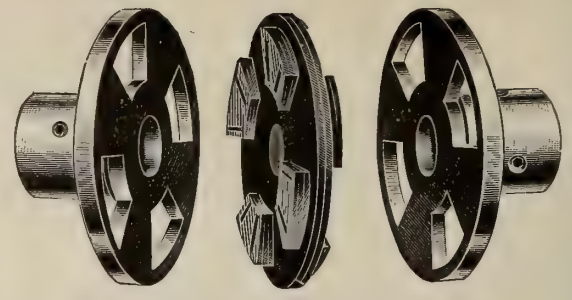
The advertiser would like to know where you saw his advertisement—tell him.

Plate Coupling



THE BOND Quartette

Canada's Best



Grundy Flexible Insulated Coupling for direct drives.

Will outwear any other Flexible Coupling

Clamp Compression Coupling

The Couplings that have been tried and found true

The "Bond" Patent Spiro Compression Coupling

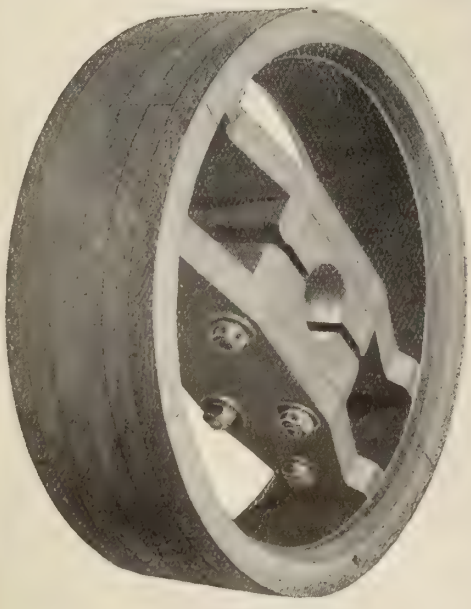
50% more gripping force than any other Compression Coupling

Ask for Catalogue No. 25 for anything in transmission.

Canadian Bond Hanger & Coupling Co., Ltd.

ALEXANDRIA, ONTARIO

A Combination Hard to Beat



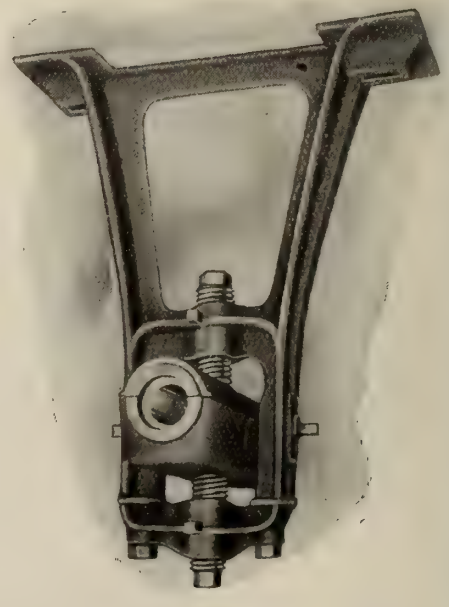
Elmira Ball and Socket Hangers

Elmira Wood Split Pulleys

The Elmira B. & S. Hangers are designed to meet the hardest and most exacting conditions. They are of good weight, correct design, and well proportioned. A Duplex system of oiling is employed consisting of tempered steel rings and woven cotton wick.

The Elmira Pulley is built to stand the hardest service and most severe conditions. The rim is nailed throughout. The arms are tenoned into the rim and dowelled there. The pulley is guaranteed to run wherever a leather belt will give satisfaction.

Send for our Illustrated Catalogue "C"



Large and complete stocks carried at Elmira, and by

The A. M. ELLICOTT CO., 301 St. James Street, Montreal, Que., Sole Eastern Agents.

Elmira Machinery & Transmission Co., Limited - - Elmira, Canada

EQUAL TO THE EMERGENCY

MARTIN L. BALDWIN
FOUNDER & MACHINIST

St. Clair, Mich., July 27th, 1912.

Gentlemen:—

Noting testimonials on the merits of Magnolia Metal, I wish to relate experience I have had with same.

Recently during midnight, the engine of the City Electric Light Plant broke down owing to babbitt running out. I routed the local hardware man out of bed to secure a supply of MAGNOLIA. In my hurry to get engine going again, I failed to provide either oil holes or grooves in the bearings. In the morning my mistake occurred to me, so I hustled to the plant, and, to my astonishment, I found engine running as smooth as glass, and not heating. This was surely remarkable, when you consider not a drop of oil was reaching the bearings. We ran her a number of days before taking apart again.

This substantiates your claim that MAGNOLIA METAL is a self-oiling babbitt. We use it on all of our repair work.

Very truly yours,

MARTIN L. BALDWIN.

SOLD BY LEADING DEALERS EVERYWHERE OR BY

MAGNOLIA METAL CO.

OFFICE AND FACTORY:

225 St. Ambroise St. **MONTREAL**

The advertiser would like to know where you saw his advertisement—tell him.

"Maple Leaf" Brand

Stitched Cotton Duck Belting

THE BEST FOR ALL KINDS OF BELTS

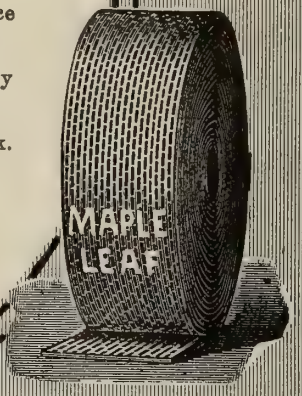
Means Reduced Upkeep Expense and Efficient Service

There is a "Maple Leaf" Belt for every service from the heaviest drive to the smallest light belt.

It is durable under dry or wet conditions, and is by far the most economical belting that you can use.

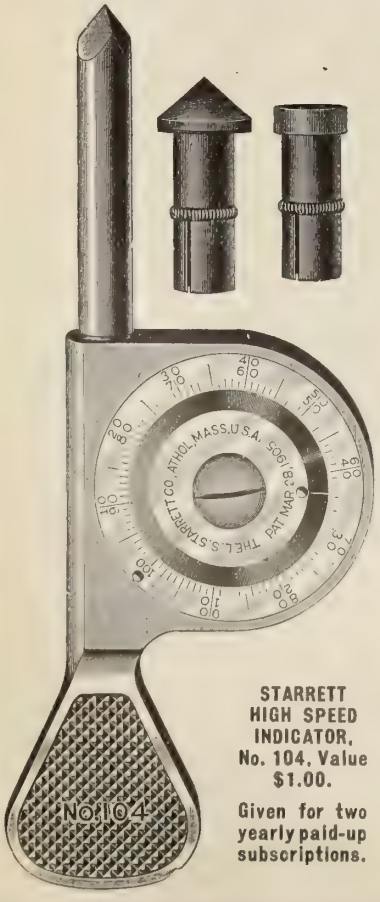
It is made by experts from plies of selected duck. Absolutely guaranteed.

Ask us for further information and prices.



Dominion Belting Co., Ltd.,

HAMILTON, CANADA



STARRETT HIGH SPEED INDICATOR, No. 104. Value $1.00.

Given for two yearly paid-up subscriptions.

You May Have This Speed Indicator without Spending a Cent

if you are a subscriber to "THE POWER HOUSE." If you are not a subscriber, send in your own subscription together with two others, and the indicator you are entitled to will be mailed to you immediately.

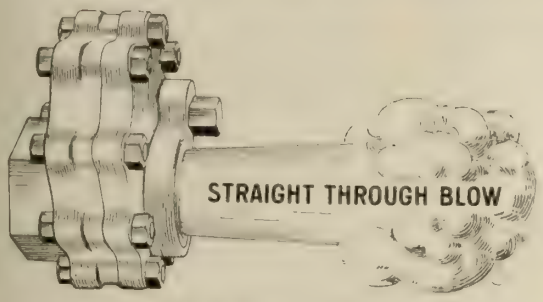
To subscribers who send us two NEW yearly paid-up subscriptions we will send this $1.00 Indicator.

"THE POWER HOUSE' is designed to give Canadian Engineers, Superintendents and Power Users all the latest and best information in the engineering field A little work among your engineer friends and acquaintances wil earn for you this handy indicator without any trouble. Try it and see how easy it will be.

PUBLISHED MONTHLY AT $1.00 PER YEAR
Start in TO-DAY to earn one of these Handy Tools.

THE POWER HOUSE 143 University Ave., **Toronto**

EVERLASTING
BLOW-OFF VALVES



IT NEVER LEAKS!

WRITE FOR PRICES

200,000 IN USE

Does your Boiler leak, Mr. Engineer?

How often do you blow it?

The "EVERLASTING" is the only perfect blow off valve on the market.

No stuffing box—requires no packing—is self-cleaning, and has a self-grinding seat—nothing to get out of order—What's the answer?

RELIABILITY—SIMPLICITY.

SOLD AND MANUFACTURED UNDER CANADIAN PATENTS BY

Engineering Specialties Company, 1080 King St., West, TORONTO

LIMITED

AGENTS

MONTREAL, QUE.
H. L. Peiler & Co.

ST. JOHN, N.B.
The A. R. Williams Mach. Co.

WINNIPEG, MAN.
The A. R. Williams Mach. Co.

CALGARY, ALTA.
P. D. McLaren Limited

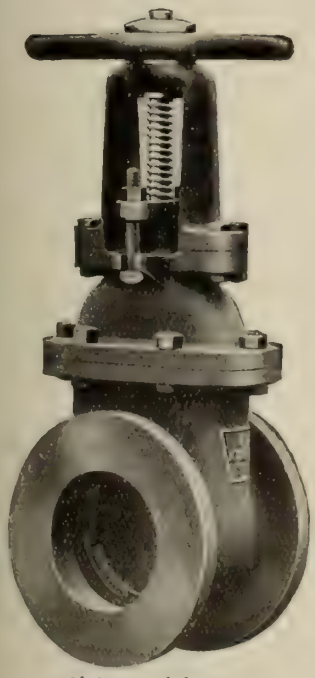
VANCOUVER, B.C.
Taylor-Forbes Company, Limited

KERR GATE VALVES

OUTSIDE SCREW AND YOKE

"KEYSTONE" PATTERN

Embody all the latest features



4½-in. and larger

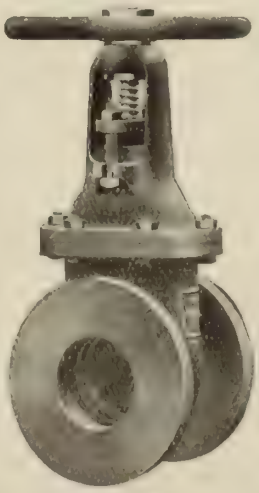
Screwed in Seats

Deep Bronze Bushed Gland and Stuffing Boxes.

Full Opening.

Large Diameter Hand-Wheels.

Solid Wedge Discs.



4-in. and smaller

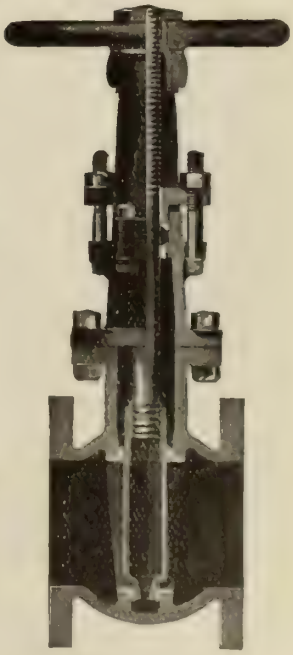
Narrow face-to-face Dimensions

Symmetrical Design.

Good Material.

Interchangeable Parts.

Guaranteed Tested.

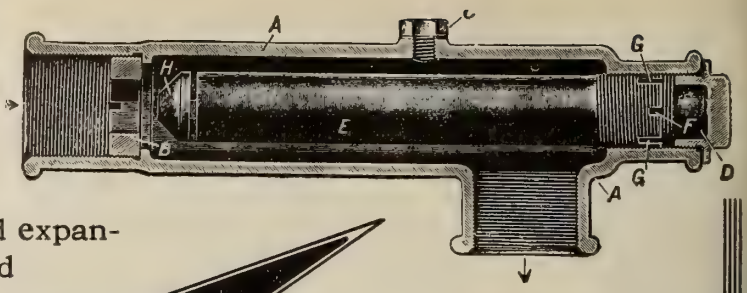


4½-in and larger

The Kerr Engine Co., Limited, MANUFACTURERS
Walkerville, Ontario

The advertiser would like to know where you saw his advertisement—tell him.

The Trap of Proven Merit
Over 300,000 In Use



The SAMSON STEAM TRAP, liquid expansion type, possesses superior merit and costs less, and is good for 125 lbs. pressure and superheated steam. SPLENDID VACUUM VALVE.

The SAMSON STEAM TRAP

We will install and guarantee any heating, ventilating and drying proposition known on the American and European continents.

GUSTAV NOBIS
Rheydt, Germany
Engineer, Manufacturer and Heating Contractor

Founded 1880

Investigate

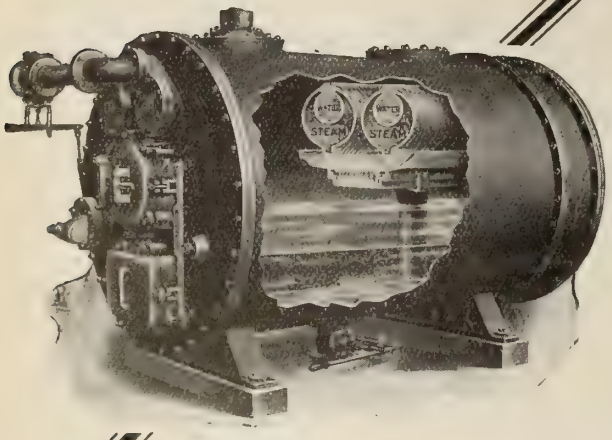
The Nobis Engineering Co.

Heating Engineers and Contractors

329 King St. West, TORONTO, ONT.

H. M. NOBIS, Heating Engineer

T. E. REGAN, Superintendent



The "National" you are going to have isn't heating your feed water To-day

It's going to be a "National" anyway—a National Closed Heater if the water is good, or a National **Direct-Contact** or open heater if the water is to be heated, purified and filtered.

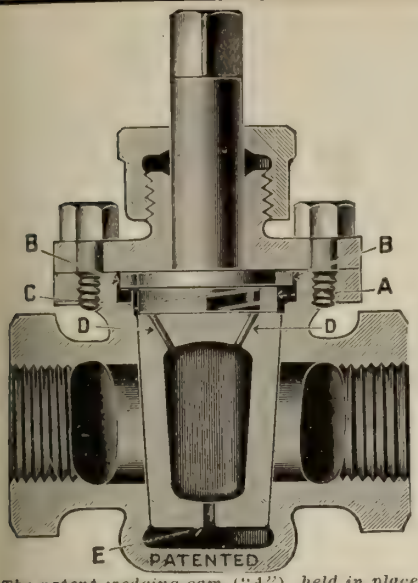
NATIONAL FEED WATER HEATERS

are described in catalogs, ask for— **Catalog No. 1, Closed Heaters**
Catalog No. 2, Open Heaters

National Pipe Bending Co.

91 Lloyd Street New Haven, Conn.

46-31



The patent wedging cam ("A"), held in place by lugs ("B", "B") at the sides which fit into slots in the valve body, holds the plug in balance and shoves it firmly downward into place as the stem is closed, releases it as the stem is turned back, and presses it down again as the valve is full open. The seat is always protected. No packing in this valve, no bottom nut to corrode or leak. The flow strikes against the angle of the valve body, not against the plug, and is then shot straight through the port with minimum wear.

No Sticking!

HOMESTEAD QUARTER TURN VALVES

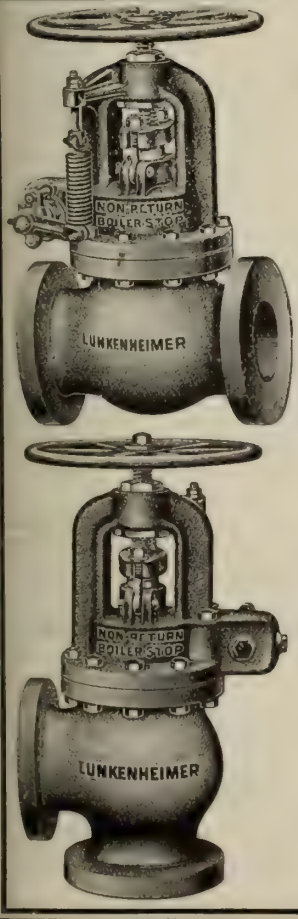
Plug Valves that open and close quick and easy. And they're *tight* when shut.

The best valves you can invest in for boiler Blow-Off, Blow-down Columns, for Hydraulic and Pneumatic Machines, and for handling acids, ammonia, caustic soda, etc.

Write NOW for full information. Our new catalog "R" sent for the asking.

Homestead Valve Mfg. Co., Pittsburgh, Pa.

New York Sales Office, 1136 Park Row Building



LUNKENHEIMER NON-RETURN SAFETY BOILER STOP VALVES

In any steam plant where two or more boilers are installed in battery, the outlet from each boiler where same is connected to the header, should be provided with a **Lunkenheimer Non-return Safety Boiler Stop Valve.**

Should the pressure in one of the boilers suddenly decrease, caused by an accident, a **Lunkenheimer Non-return Safety Boiler Stop Valve** is guaranteed to close immediately and prevent the steam from the other boilers of the battery entering and discharging through the disabled one. Danger to life and property is greatly lessened, and as the plant can be operated with the other boiler, or boilers, without interference, considerable time and money are saved.

Chattering of the disc, caused by the fluctuation of the steam pressure, is prevented by an ingenius outside spring arrangement.

Lunkenheimer Non-return Safety Boiler Stop Valves are exceptionally strong, durable and reliable. All parts subjected to wear are renewable. Made in five different combinations of material to suit the requirements of various conditions of superheat and high pressure, and to meet the specifications of engineers who may differ as to what is best suited to the purpose.

Your local dealer can furnish them; if not, write us.
Write for Catalogue.

THE LUNKENHEIMER COMPANY

Largest Manufacturers of High-Grade Engineering Specialties in the World 10-43
General Offices and Works: CINCINNATI, OHIO, U. S. A.

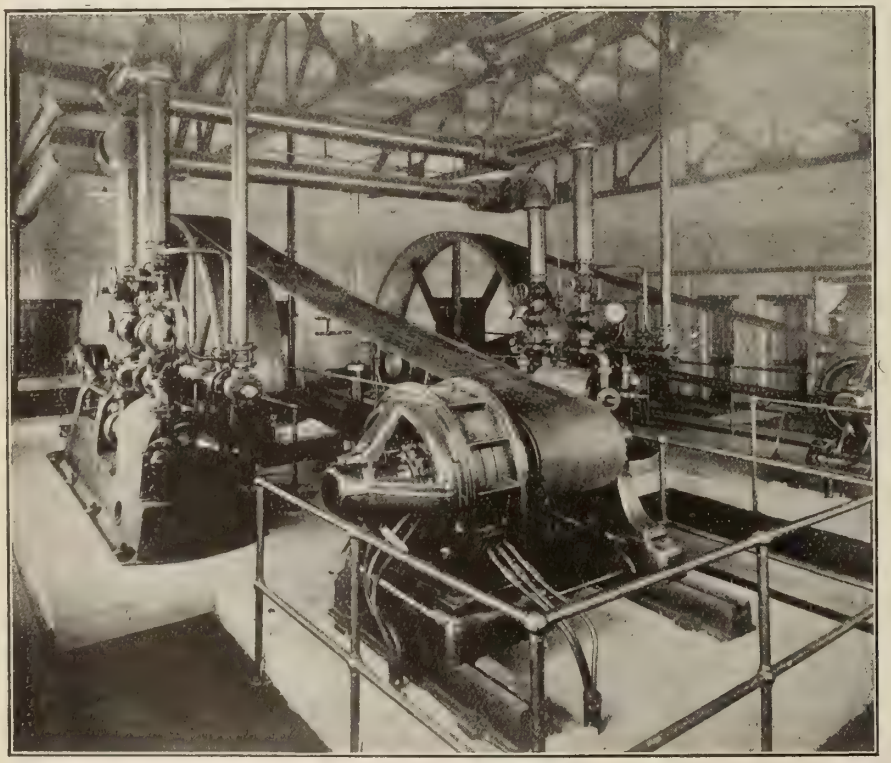
NEW YORK,	CHICAGO,	BOSTON,	LONDON, S. E.,
64-68 Fulton St.	186 N. Dearborn St.	138 High St.	35 Great Dover St.

"THE LINDE"

REFRIGERATING and ICE-MAKING MACHINERY

CORK INSULATION

Over 8,000 Machines in use. Established and Manufacturing in Canada for 16 years.



Two 100-ton "Linde" Belt Drivers, Double Acting, Horizontal Ammonia Compressors Manufactured and Installed by us in Canada.

Recent Orders:—

IMPERIAL BREWING CO., (3 orders), Kamloops, B.C.
WM. CLARK, LTD., Montreal, Que.
MR. J. A. PATRICK, New Westminster, B.C.
C.P.R. VANCOUVER HOTEL, Vancouver, B.C.
MATTHEWS-LAING, LTD., Fort William, Ont.
CARSON'S HYGIENIC DAIRY CO., Winnipeg, Man|
ST. THOMAS PACKING CO., St. Thomas, Ont.
MONTREAL GENERAL HOSPITAL, Montreal, P.Q.
OTTAWA UNIVERSITY, Ottawa, Ont.
WM. DAVIES CO., Winnipeg, Man.
CANADIAN NATIONAL EXHIBITION, Toronto, Ont.
McGILL UNIVERSITY, Montreal, P.Q.
G.T.P. FORT GARRY HOTEL, Winnipeg, Man.
C.P.R. ALGONQUIN HOTEL, St. Andrews, N.B.
AND MANY OTHERS.

The Linde Canadian Refrigeration Co.,

Limited

37 ST. PETER STREET, MONTREAL

Branch Offices—Toronto, Imperial Building, Adelaide St.; Winnipeg, 909½ Main Street; Vancouver, Anderson & Miskin, Imperial Block, Seymour and Pender Streets; Edmonton, Walker & Barnes, 562 Second Street; Calgary, General Supplies Limited, 1233 2nd Street East.

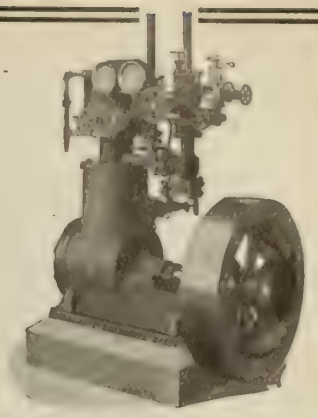
The advertiser would like to know where you saw his advertisement—tell him.

ESTABLISHED 1867.

THE VILTER MANUFACTURING CO.

242 BECHER ST., MILWAUKEE, WIS., U.S.A.

A small machine for small Ice-making and Refrigerating Plants, as well constructed and as successful in operation as larger outfits. VERTICAL SINGLE-ACTING AMMONIA COMPRESSORS, different sizes. Built with fewest possible number of parts. Sold at low price. Excels all others of like size in every point—simplicity, efficiency, reliability, smoothness of action, etc. We build horizontal and vertical ICE-MAKING AND REFRIGERATING MACHINERY, a full line of CORLISS ENGINES, and MACHINERY FOR BREWERS AND BOTTLERS. Our plant covers more than eight acres of ground.



Vertical Single-Acting Ammonia Compressor. Enclosed Type for Belt-drive.

The

LINDE BRITISH

Refrigeration Co. Limited

¶ Numerous fully authenticated laboratory tests organized from time to time in America and Europe, have invariably served to demonstrate in an unanswerable manner, the very remarkable degree of mechanical efficiency to which our products have been brought. ***The history of mechanical refrigeration is our history.***

Head Office: LONDON, ENG.

BIRMINGHAM	GLASGOW	JOHANNESBURG, S.A.
BRISTOL	BOMBAY	SYDNEY, N.S.W.
LIVERPOOL	CALCUTTA	PORT NAPIER, N.Z.

CANADIAN OFFICES
CORISTINE BLDG
MONTREAL

Self-Lubricating

In Cans
6, 12, 25 and 50 lbs.

SAFETY PLASTIC

METALLIC PACKING

LASTS FOR YEARS AND NEVER WEARS THE PISTON ROD.

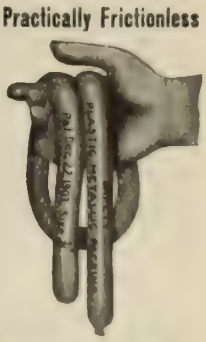
Guaranteed to stand steam temperature up to 550 degrees Fahr.
Guaranteed to stand hydraulic pressure to 5,000 pounds per square inch.
Packing furnished in bulk and in thin Cotton Tubes, sizes 3-16 to 1½ inch, 36 inches long, or in special lengths to fit your stuffing boxes.
Empty Cotton Tubing in assorted sizes FREE OF CHARGE with orders for the packing in bulk form.
The tubes are easily filled and they save you the expense of carrying a large stock of packings in different sizes.

Send for FREE SAMPLE and particulars.

Manufactured only by

STEEL MILL PACKING CO. WINDSOR, ONT.

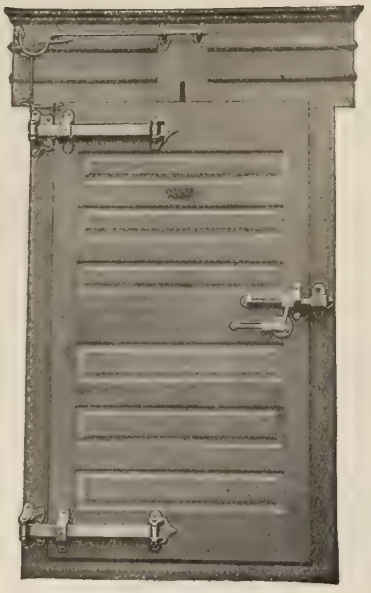
Practically Frictionless



Sold on APPROVAL

The advertiser would like to know where you saw his advertisement—tell him.

J. V. Jamison, President. T. B. South, Vice-President. J. V. Jamison, Jr., Treasurer.



THIS IS A CONTRACT

Looks Fair to Us. It is Fair

We invite users of Refrigerator Doors and Windows who are contemplating erection or remodeling plants to write us for

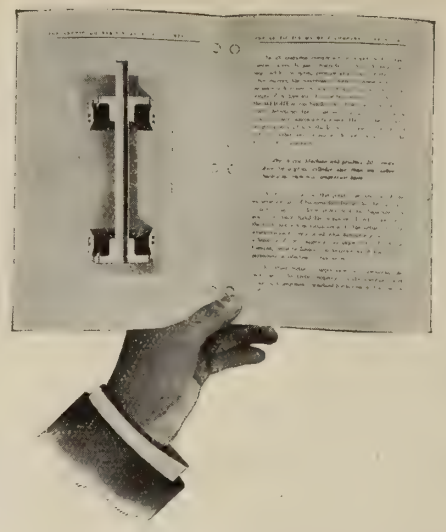
Sample Door and Frame Complete

We will forward it to size required. If it is not satisfactory from every standpoint to **you** in style, workmanship, efficiency and plan, it is your property without charge or any obligation to us whatever. We feel justified in making the above offer, to show our foreign friends our good faith. We have no Agents, either here or in your great country, to exhibit and present our products. In this proposition we hope to prove that we merit your confidence.

Our patronage in Canada is very large and general. A few of the largest sales are to:—

Linde Canadian Refrig. Co.	Montreal, Can.
P. Burns & Co.	Calgary, Alta.
Swift Canadian Co.	Toronto, Ont.
Whyte Packing Co.	Brockville, Can.
Moose Jaw Cold Storage Co.	Moose Jaw, Sask.
Standard Milk Co.	Vancouver, B.C.
Edmonton City Dairy Co.	Edmonton, Alta.
Canadian Fish & C. S. Co.	Prince Rupert, B.C.

Jones Cold Store Door Co.
HAGERSTOWN, MD. U. S. A.



Don't Miss Your Copy!

It's Free.

The most interesting bulletin issued in many a day on the question of ice and refrigerating machinery.
Of course, it says some things about "Arctic" you want to know!

"WE DO IT RIGHT"

THE ARCTIC ICE MACHINE CO.
CANTON, OHIO

Ice and Refrigerating Machines

THE COMING AMMONIA COMPRESSOR

THE "SAFETY"

Built by

The HUETTEMAN & CRAMER CO.
DETROIT, MICH.

Complete Ice Making and Refrigerating Plants for every conceivable purpose.

SIX OF THESE "SAFETY" INSTALLATIONS TO DATE IN ONTARIO THIS SEASON

TRY J-M PERMANITE PACKING ON AMMONIA LINES OR WHEREVER PACKING IS PUT TO A SUPREME TEST

It makes no difference how trying the conditions are in ammonia lines, acid, alkali, sugar solutions or steam lines, steam chests, steam cylinders, etc., J-M Permanite Sheet Packing cannot fail to give satisfaction.

It withstands the highest steam pressures and temperatures. Ammonia, acids, boiler compounds, compressed air, oil, etc., do not affect it in the least.

If you are bothered with plant conditions that require an excessive amount of time and expense on packing—if other packings have failed to give satisfaction, you can overcome your difficulties by using J-M Permanite.

There is no other packing that possesses the great heat and pressure-resisting properties and the durability of J-M Permanite. It will last indefinitely. It will not burn nor squeeze out, nor will it stick to the flanges.

If this packing is all we say it is, you want it in your plant. So we offer to let you prove our statements at our expense. Let us send you enough J-M Permanite to test under the most trying conditions.

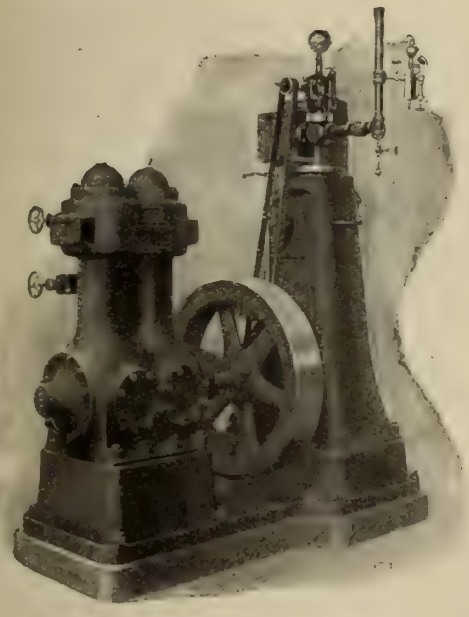
Write our nearest Branch to-day for Samples and Booklet.

THE CANADIAN H. W. JOHNS-MANVILLE CO., Ltd.

Manufacturers of Asbestos and Magnesia Products — TRADE ASBESTOS MARK — Asbestos Roofings, Packings, Electrical Supplies, Etc.

TORONTO MONTREAL WINNIPEG VANCOUVER

1374



½ to 17 tons Refrigerating Capacity

A Good Refrigerating Machine

Our Enclosed Vertical Single-Acting Machines are designed for service. They are self-contained, with all parts interchangeable. Have Die Forged Crank Shafts ground to gauge, with Die Cast Bearings, Oil Enclosed Crank Cases, Ground Pistons and Rings. Engine has enclosed frame with water-shed partition and automatic force feed lubrication.

Each Machine is put in operation on our testing blocks and rigidly inspected before shipment. These Machines need but little attention, and do not require a skilled Operator.

For catalog, information, or prices, write to

YORK MANUFACTURING COMPANY

Main Office and Works: YORK, Pa., U.S.A.

Represented in the Dominion by

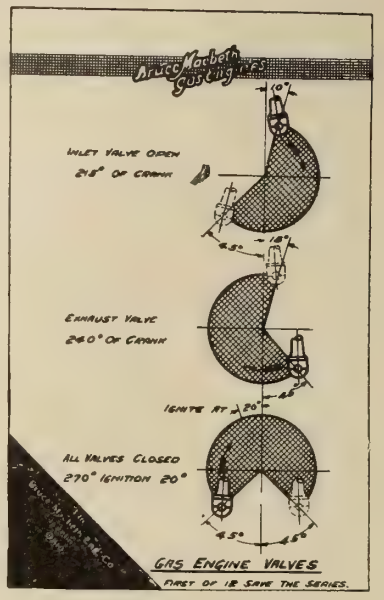
CANADIAN ICE MACHINE COMPANY

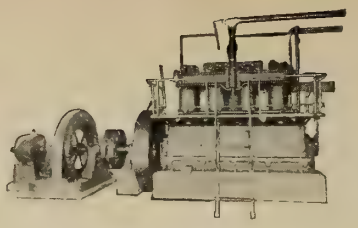
163-167 Yonge Street TORONTO

P. O. BOX 336

The advertiser would like to know where you saw his advertisement—tell him.

Bruce Macbeth Gas Engines





SOME BRUCE-MACBETH INSTALLATIONS IN CANADA SINCE THE FIRST OF THIS YEAR:

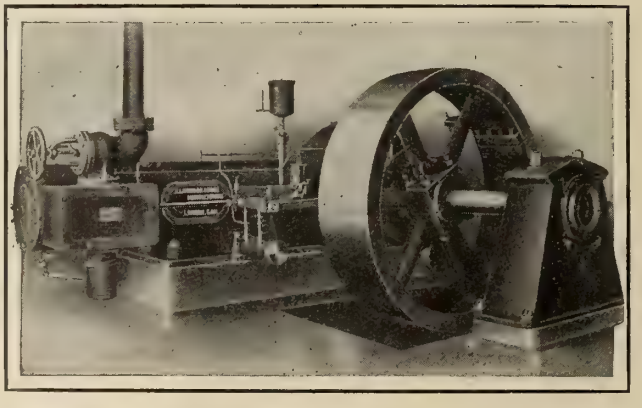
The Sydenham Glass Co., Wallaceburg, Ont.: one 350 H.P. Bruce-Macbeth 4 cylinder engine, direct connected to a 60 cycle, 3-phase alternator.

The Diamond Flint Glass Co., Redcliffe, Alberta, two 150 H.P. Bruce-Macbeth Engines.

The Wallaceburg City Lighting Plant, Wallaceburg, Ont.: one 150 H.P. Bruce-Macbeth Engine.

This is the first of a series of 12 blue print post cards. Each one contains some valuable information. A set sent on request.

THE
BRUCE-MACBETH ENGINE CO.
2127 CENTER ST. N.W.
CLEVELAND



Side Crank Leonard Automatic Engines

Particularly adapted for Direct Dynamo Connection and Electric Light Service. Made in Simple and Compound Units up to 500 Horse Power. For High Economy and Close Regulation this engine is unexcelled.

We also make High and Slow Speed Corliss Engines for Heavy Duty Service. Our "Tangye" Engine is very well and favorably known throughout Canada for Sawmill Work.

MADE BY

E. LEONARD & SONS, LONDON, ONTARIO

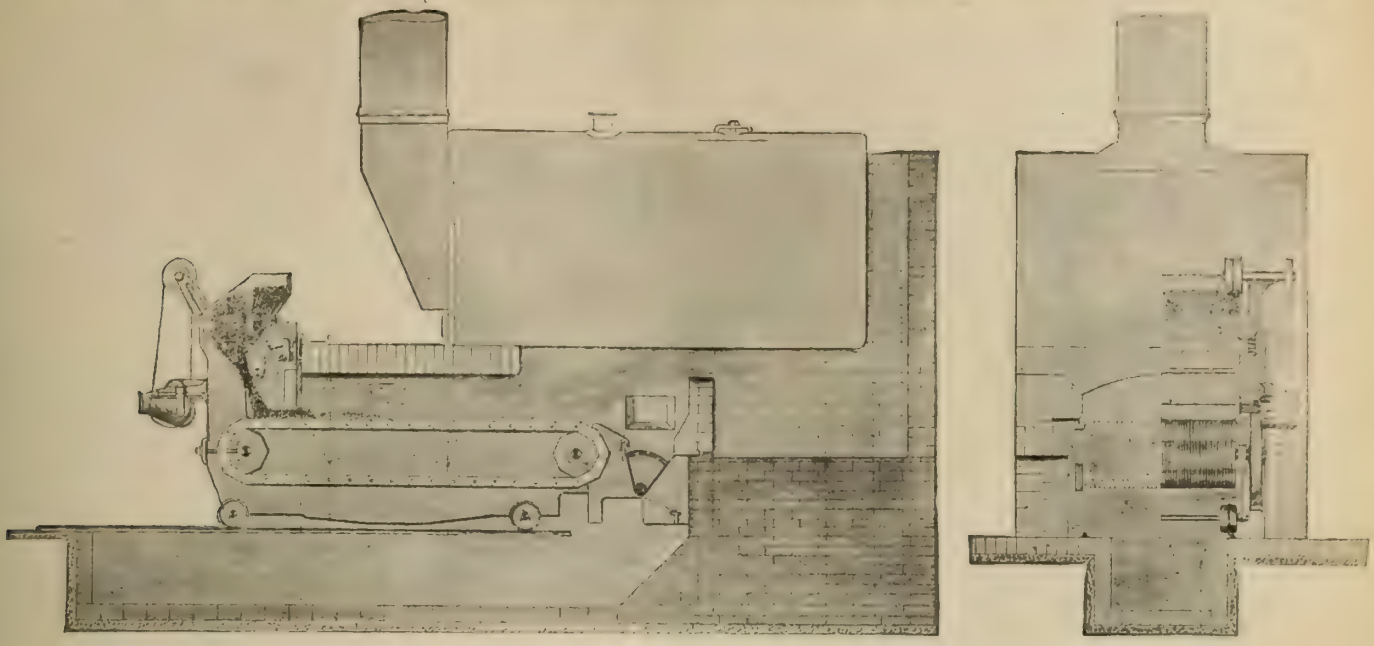
MANUFACTURERS OF

High and Slow Speed Engines of all kinds, Boilers, Heaters, Pumps, etc., etc., and complete Steam Plants.

WAREHOUSES AND AGENCIES AT

MONTREAL, ST. JOHN, N. B., CALGARY, WINNIPEG, VANCOUVER

The Chain Grate Machine-Stoker That Matters



— BENNIS PATENT CHAIN GRATE STOKER APPLIED TO HORIZONTAL RETURN TUBE BOILER —

There is one machine-stoker for CHEAP steam-raising with water-tube boilers. It is the BENNIS Chain Grate, with the new strong **Bennis** patent link, which does not burn out, and keeps clear, strong fires with low-grade, small fuels.

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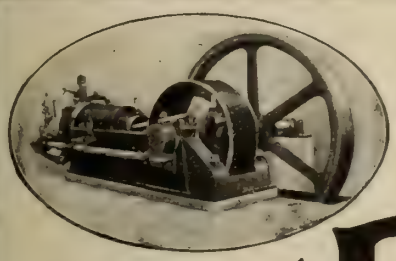

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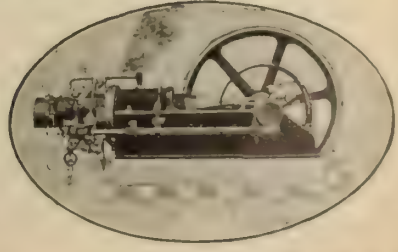

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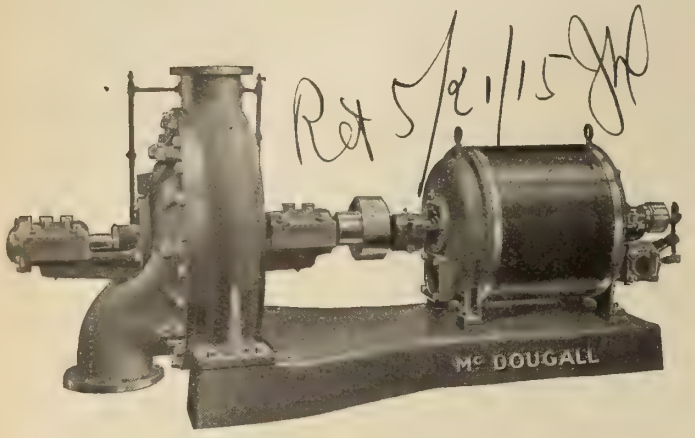
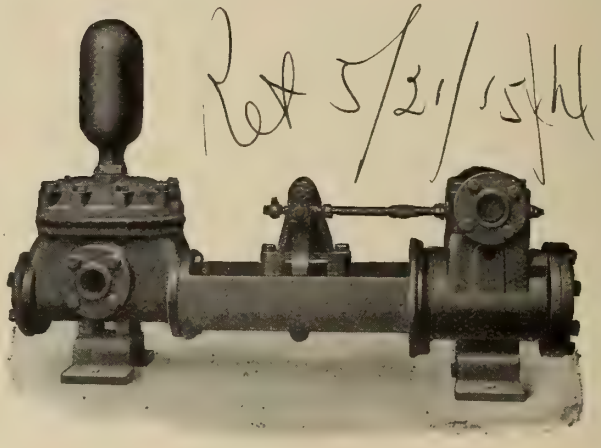


Worthington Turbine Pump driven by Steam Turbine, capacity 1,000 Imp. Gals. per min. against a head of 150 ft. For other applications of turbine pumps see Bulletin 108.

Blake Simplex Steam Pump, built for 250 lbs. per square inch, working steam and water pressure, but sold at same price as so called "trade" pumps. See Bulletin 875.



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Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

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Storey upon Storey—Story upon Story

¶ Cass Gilbert, architect of the cloud-high Woolworth building, didn't stop the contractors when they had the first floor steel up, because the building didn't look finished.

¶ He was content to wait while, storey after storey, higher and higher, the structure reared its bones above the common level.

¶ He was satisfied to wait while the details of his plans were worked out—piece by piece, storey by storey, week after week, month after month, until the finished giant stood out one day in all its glory—catching the first rays and the last of an approving sun.

¶ He had a vision of the giant structure when the plans were drafted. He knew that success was ahead. The owners of the building had confidence in him and backed him up. The contractors followed specifications to the letter, and a big success and an everlasting monument to man's genius, nerve and pertinacity was the result.

¶ There would be more and greater business successes if there were more Cass Gilberts as advertising managers and more Woolworths to back them up. Advertising successes are built up just as the Woolworth building was—storey after storey, according to a preconceived and well defined plan.

¶ There are too many one storeyadvertisers. They can't catch the vision of a big success, or if they can, they get dizzy-headed when they contemplate the height. They lack the nerve to back the advertising architect, and they doubt the greatest of all contractors—printer's ink.

¶ It will take months, and sometimes years to build up a big business through advertising.

¶ But once that building goes skyward, neither the adverse winds of competition, nor the earthquakes of changing conditions and hard times will ever shake it! There is only one condition—the foundation must be as solid as the rock upon which the Woolworth Building stands, and that foundation must be Honest Goods and Honest Prices and Honest Service. If you can build on these, there is no limit to the possibilities of your business. Otherwise your structure will totter and crumble over your head—as it should.

¶ Get the vision of a bigger business! Start to-day to make it a success through advertising, column upon column, story upon story, week after week. Keep at it. That's the idea! Keep everlastingly at it till results come in a satisfying measure.

¶ And then keep on keeping on!

Rate card and full information gladly furnished.

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A monthly publication devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power.

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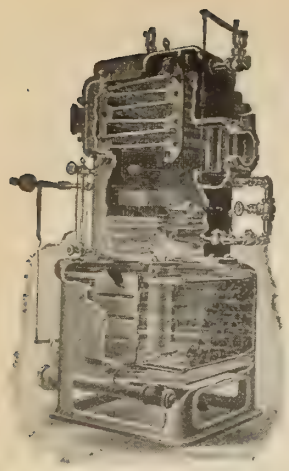
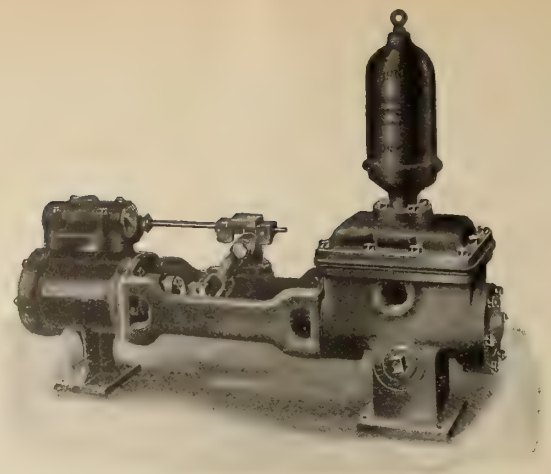


Webster Feed Water Heaters



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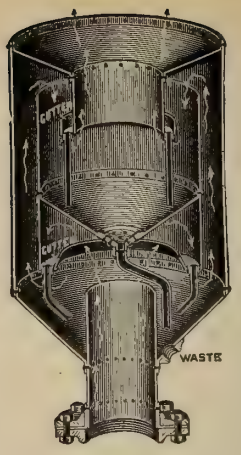
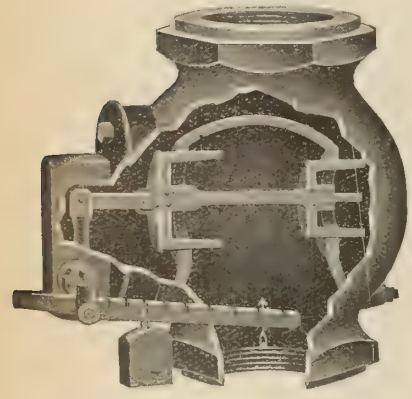


The "Cyclone" Exhaust Head



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WE fully guarantee all goods of our make to be of the highest standard of quality, as regards material, construction and workmanship; and that each device, when properly installed, will satisfactorily perform the service for which it is designed.

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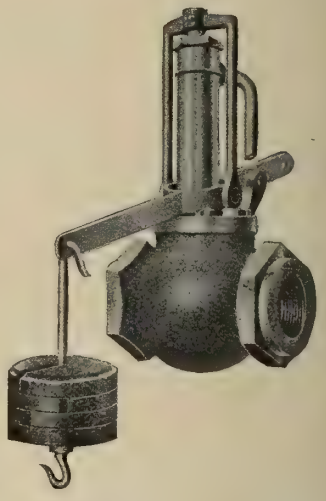
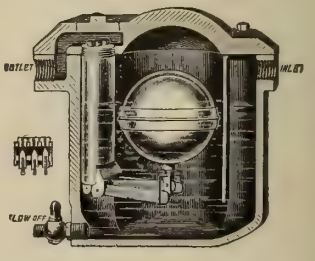


High-Pressure Reducing Valve

Blow-off Tank



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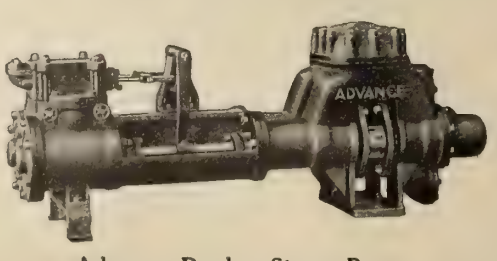
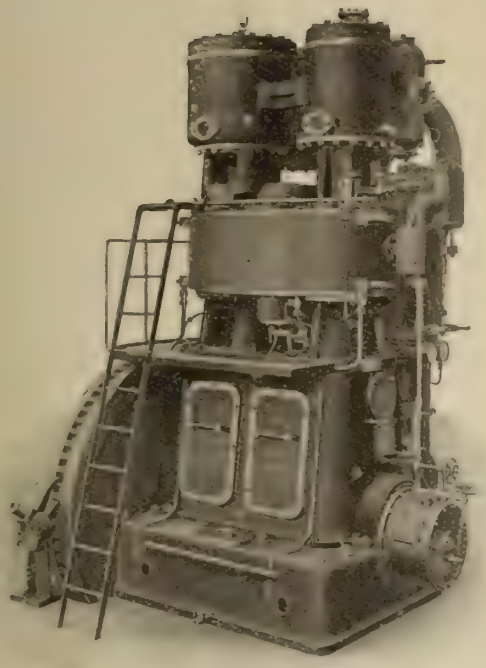


Advance Duplex Steam Pumps

Webster Steam Separator

AIR COMPRESSORS



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"ROGLER HOERBIGER"
PATENT VALVES ARE USED
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NO ELABORATE MOTION GEAR
TO OPERATE, THEY ARE
AUTOMATIC

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A MINIMUM OF POWER TO
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EMBODY THE FOLLOWING POINTS, VIZ:—

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Highly Efficient Method of Water Jacketting!

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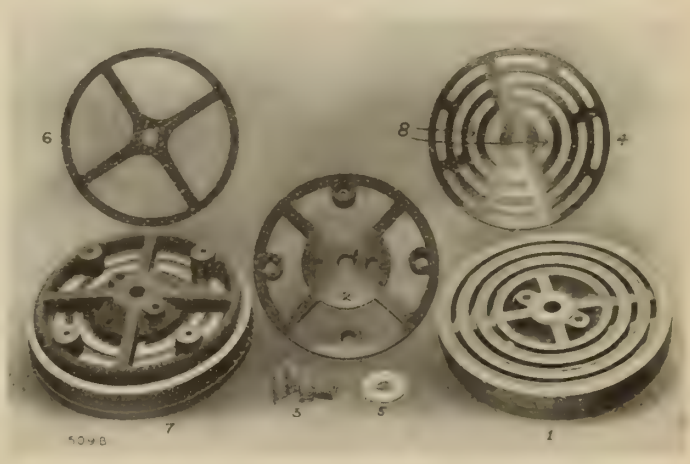

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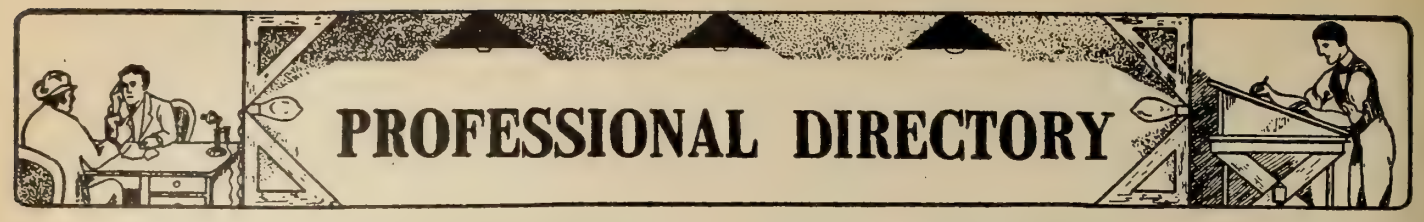

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Bare and Insulated Electric Wire

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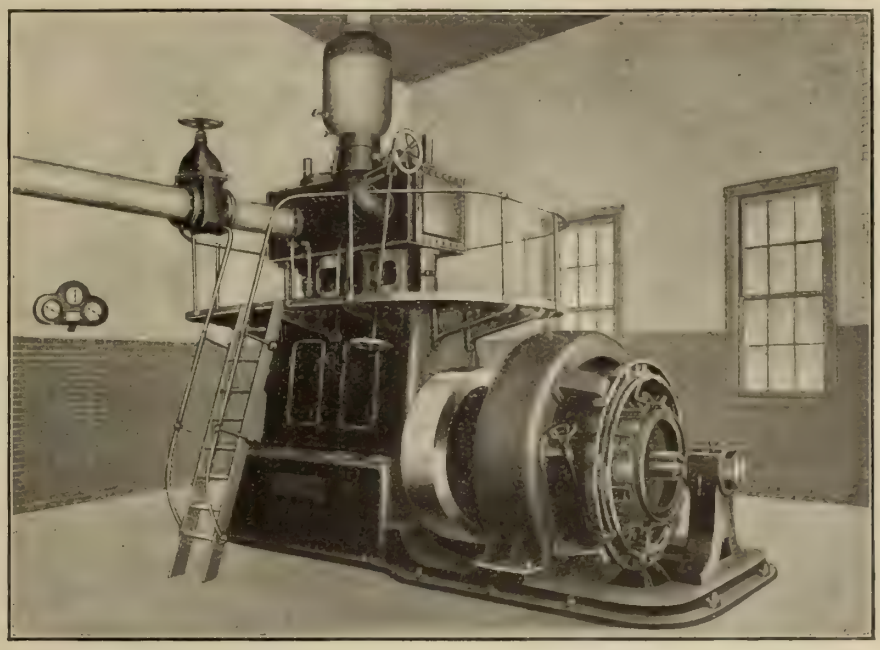
The advertiser would like to know where you saw his advertisement—tell him.

ECONOMY—the greatest word in engineering

ECONOMY OF STEAM requires a **compound engine.**
ECONOMY OF SPACE requires a **vertical high-speed** engine.
ECONOMY OF POWER requires **automatic governing.**
ECONOMY OF TRANSMISSION requires **direct connection.**



ECONOMY OF ATTENDANCE requires **automatic forced lubrication** and **complete enclosure** of all moving parts.
ECONOMY OF MAINTENANCE requires an **up-to-date design,** highest grade of **workmanship,** and **interchangeable parts.**

ALL THESE ECONOMIES ARE ASSURED IN THE

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MANUFACTURERS OF

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Works: AMHERST, N.S., Canada **SOUTH FRAMINGHAM, MASS.**

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39-45

G. & McC. VERTICAL QUICK REVOLUTION STEAM ENGINES

Will give you as they are giving others wherever installed

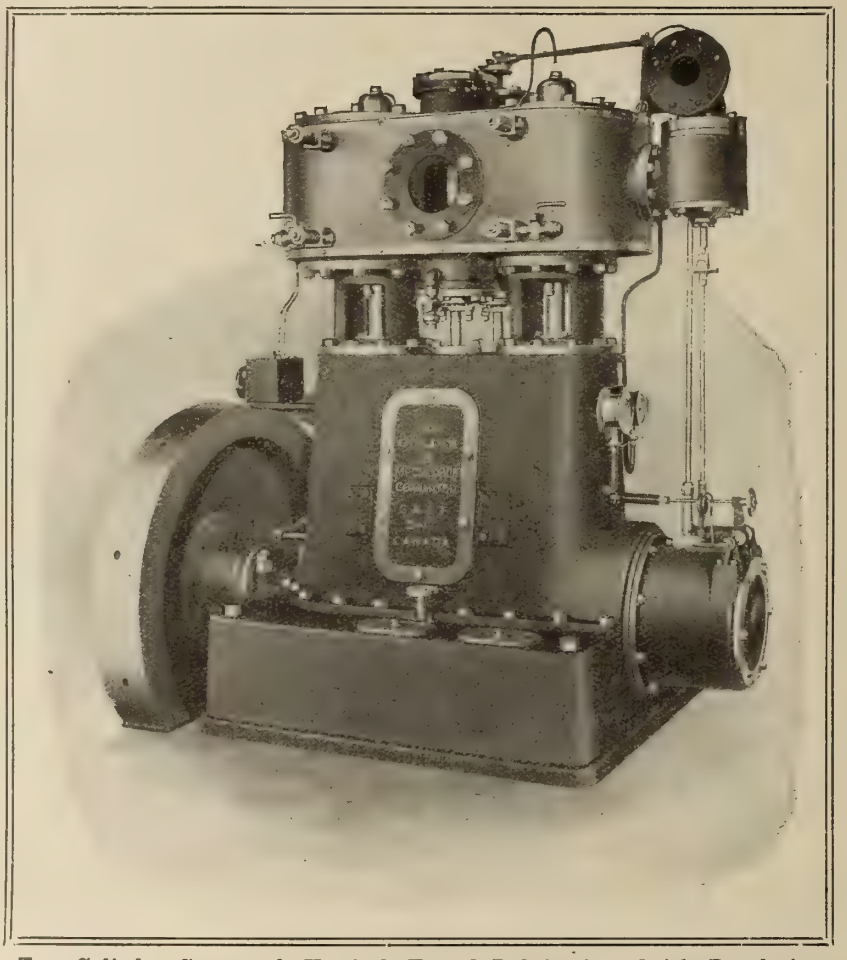
A MAXIMUM OF SERVICE

At a Minimum Cost of Upkeep

These Engines have a Perfect System of forced Lubrication.

They require little or no attention while running.

Built in all types and sizes.



They run with Practically no Noise or Vibration.

All working parts are very easy of Access.

Built to suit your Particular Requirements.

Two Cylinder Compound, Vertical Forced Lubrication, Quick Revolution Steam Engine, with Combined Throttle and Expansion Governor.

All the materials used in the Manufacture of Vertical, Quick Revolution Engines must be the best obtainable. In the construction of our Engines particular attention has been paid to this feature; the materials supplied being in accordance with **British Admiralty Specifications.** All Engines are tested under steam before leaving our works.

We shall be pleased to furnish Specifications and further information.

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The advertiser would like to know where you saw his advertisement—tell him.

The Winnipeg Electric Railway Co. Auxiliary Steam Plant

Steam power plants continue to hold their own, not only as primaries in the generation of electric power, but as necessary adjuncts of their rival and importunate competitor, the hydraulic or hydro-electric, to the installation of which the natural waterways of Canada so admirably lend themselves. The accompanying article deals with a plant auxiliary to a hydro-electric equipment.

THE auxiliary steam plant of the Winnipeg Electric Railway Co., consists, in its leading features of two batteries of Babcock & Wilcox water tube boilers—ten boilers in all, equipped with New Model Roney Stokers of the Westinghouse Machine Co., Pittsburg, manufacture; Foster superheaters and 3-six stage Curtis horizontal steam turbines, direct coupled to 3,000 k.w., 3 phase, 60 cycle, 1,800 r.p.m. alternators. These, and the supplementary equipment, hereafter detailed, contribute to make this plant unique in its up-to-dateness of layout. The preparation of the necessary plans was entrusted to Pratt & Ross, consulting engineers, Winnipeg, Man., to whom we are indebted for the data and illustrations, and to whose energy, foresight and capacity for the work, the successful results obtained from the operation of the plant are largely due. Fig. 1 shows the receiving station for the transmission lines from Lac du Bonnet hydro-electric plant, 300 feet from the Red River, with the power house addition in rear. Condensing water and that for other purposes around the plant is drawn from the Red River.

FIG. 1.—RECEIVING STATION WITH POWER HOUSE ADDITION IN REAR.

Boiler Equipment.

The boilers, which are set separately in two rows, have a nominal rating of 651½ h.p. each, a heating surface of 6515 sq. ft., and occupy a space of 23 ft. 6 in. by 15 ft. 5 in. Each boiler consists of 21 sections, each having 14 tubes, 4 in. dia. by 18 ft. long, expanded into wrot steel staggered headers, and 3 steam and water drums, 42 in. diameter by 24 ft. 7 in. long. A mud drum at the rear of each boiler is provided with hand holes and two blow-off connections running into a main which discharges into the overflow at the gate house. The boilers have a guaranteed evaporation of 30,500 pounds of steam per hour, from and at 212 degs. Fah., and are constructed for a working steam pressure of 200 pounds per sq. inch, and a hydraulic test pressure of 300 pounds per sq. inch. The illustration, Fig. 2, shows the boiler room with passage between the two boiler batteries, the mechanical stokers, and suspended coal bins. The Roney stokers, with which the boilers are equipped, and to which reference has already been made, are designed to develop 150 per cent. of full rated boiler capacity, on a basis of 10 sq. ft. effective heating surface, with a draft equivalent to ½ inch of water. The stokers are operated by four Westinghouse vertical engines at 100 lbs. per sq. in. working pressure, and are capable of producing the evaporation of 10.2 pounds of water per pound of dry coal. The grate area of each boiler is 127 sq. ft., which gives a ratio of about 1 to 51 sq. ft. of heating surface. We under-

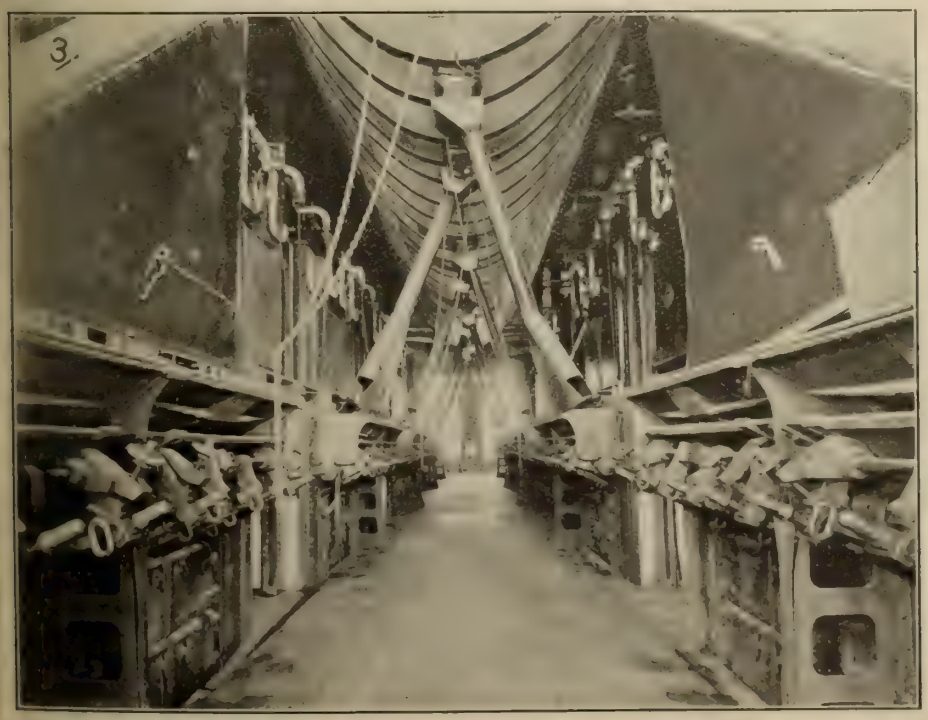


FIG. 2.—BOILER ROOM SHOWING BOILER FRONTS, MECHANICAL STOKERS AND SUSPENDED COAL BINS.

stand that a determining factor in the choice of the Roney stoker was its flexibility in picking up and handling emergency loads, and operation results have confirmed its choice, as both boilers and stokers are giving the highest satisfaction. The Foster corrugated type superheater, of which Laurie & Lamb, Montreal, are the Canadian representatives, is guaranteed to deliver to the turbine units, 22,4676 pounds of steam per hour, at 200 pounds per sq. inch pressure, with a superheat of 125 degrees.

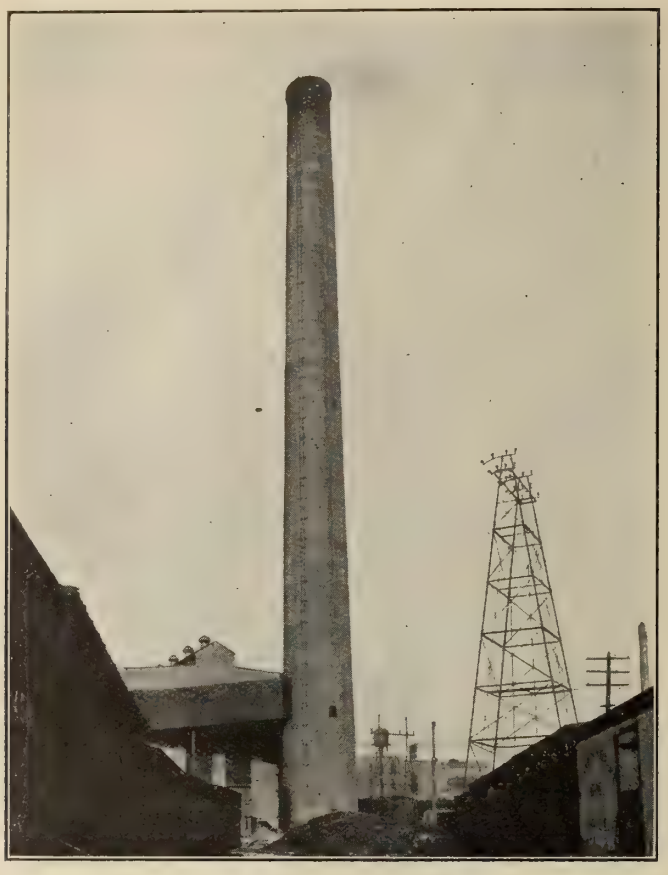


FIG. 3. REINFORCED CONCRETE STACK.

Coal and Ash Handling Equipment.

A motor-driven Clark shovel brings the coal to the door of the railroad box car, from which it drops into the receiving hopper. It is then carried by a 30-inch apron feeding conveyor of 45 feet length, and operating at a speed of 30 feet per minute, to a Link Belt boiler house crusher equipped with hardened rolls, 24 in. diameter, and 24-in. face. This crusher is driven by a 15 h.p. 220 volt, 3-phase motor, and will break run-of-mine coal into 1¼ inch cubes or smaller, and by-pass fine coal around the rolls. The coal drops from the crusher into a Peck over-lapping pivotted bucket carrier, 114 feet long between horizontal centres, and 60 ft. vertically. This conveyor is motor operated, with means for controlling its movement either from the crusher or from the conveyor motor up in the cupola. The crusher is located in the basement under the firing aisle between the boilers, and the conveyor runs up the wall at either end of the boiler room and dumps the coal into the bin suspended directly over the firing aisle. A travelling dumper is provided so that the coal may be dumped at any place in the bin. The ashes are also handled by this conveyor, being raked from the ash pit into chutes emptying into the conveyor, and the stationary dumper at the top dumps the buckets into a chute which carries the ashes outside to a holder mounted over the railway siding. The capacity of the conveyor is 40 tons of bituminous coal received as run-of-mine or slack per hour. Ashes may also be handled at the same rate. The conveyor and crusher equipment were supplied and erected by the Link Belt Machinery Co. The bin used for the coal storage is of the suspended type erected by the Brown Hoist Machinery Co., and is of reinforced concrete construction. Metal chutes with chain operated grates carry the coal to the stokers.

Boiler Feed Pumps.

Three 4-stage Mather & Platt turbine pumps are installed for boiler feed purposes in an annex to the boiler room on the basement level. They are fitted with phosphor bronze impellers, and are direct connected to 50 b.h.p. non-condensing, single stage, Curtis horizontal steam turbines, running at 2,500 r.p.m. Each pump has a capacity of 130,000 pounds of water per hour for 3 hours overload, and 89,000 pounds of water under normal load.

Smoke Breeching and Stack.

The waste gases from the boilers discharge into steel plate breechings at the rear of the boilers, and run the full length of the boiler room; the breechings, in turn, conveying their contents to

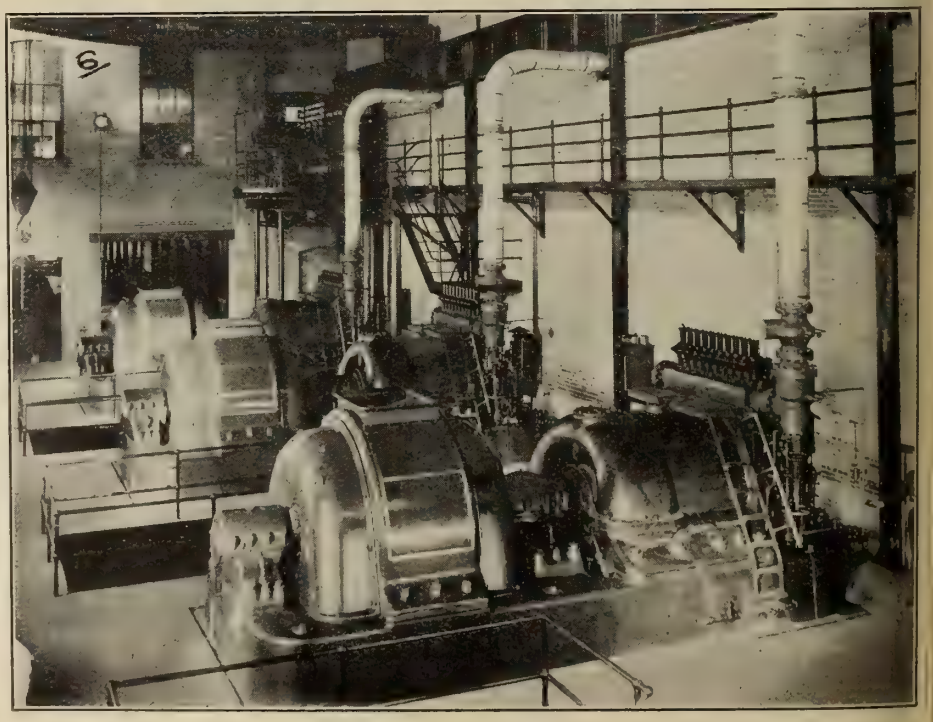


FIG. 4. NEAR VIEW OF MAIN TURBO-GENERATORS.

a Kellogg reinforced concrete chimney, 256 feet high, 24 feet diameter at bottom, and 14 feet diameter at top, Fig. 3. A few additional particulars of the stack are as follows:—

The thickness of wall varies from 14 inches at the bottom to 6 inches at the top, there being a uniform taper of 1 inch in 25 feet. The foundation, of reinforced concrete matt, 35 feet square and 6 feet deep, rests on 169-45 feet tamarack piles spaced 33 inches on centres. The vertical reinforcing is by iron bars bent at right angles to tie into the foundation reinforcing, and tied with No. 23 wire mesh for circular reinforcement. A lining of firebrick extends about 50 feet above the flue openings, and there is a concrete floor located 24 inches below the latter. The breechings are separated by a baffle wall, 9 inches thick at the stack. The furnace draft is controlled by hand, through the medium of butterfly valves in the breechings, and connections for pyrometer and draft gauge equipment are, of course, provided.

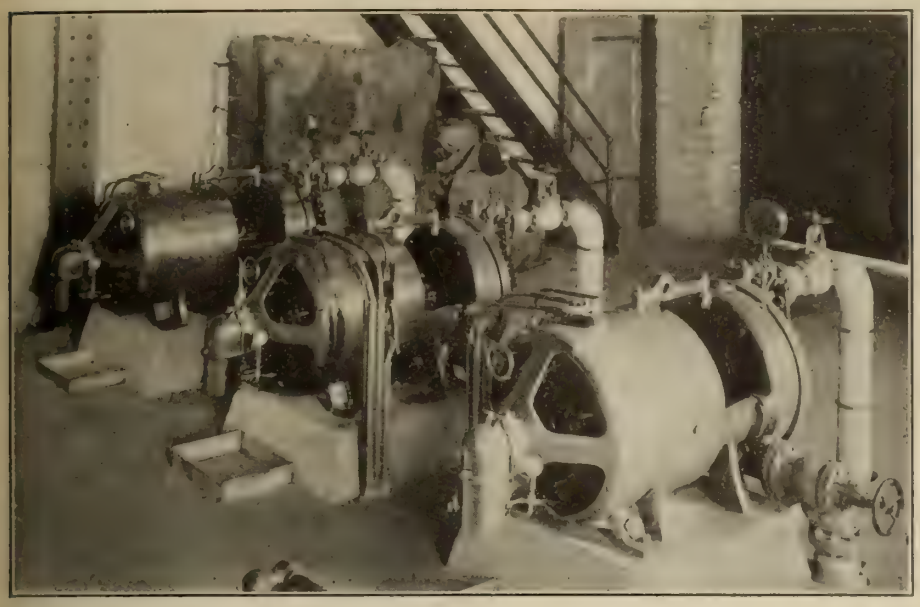


FIG. 5. VIEW OF THREE TURBINE DRIVEN EXCITERS.

Main Generating Equipment.

The main generating equipment consists of three 6-stage Curtis horizontal steam turbines, direct connected to 3,000 k.w., 3 phase, 60 cycle, 1,800 r.p.m. alternators, each complete unit having a continuous overload capacity of 4,000 k.w. Speed regulation of the turbines is 2½ per cent. from full load to no load, and that of the generators, under like conditions, is 14 per cent. Three 50 k.w. 3,600 r.p.m., 125 volt, interpole generators direct connected to single stage Curtis horizontal turbines form the exciter units for the main generating sets. The main turbines are controlled by hydraulically operated governors, which use oil under a pressure of 100 lbs. per square inch, and the generators are fitted with Tirrill regulators. The guaranteed steam consumption is 11 lbs. of steam per h.p. hour when operating at normal capacity, with 200 lbs. working steam pressure, 125 degrees super-heat, and 2 inches absolute vacuum. The floor space and height occupied by each main unit are 24½ ft. by 10 ft., and 8½ ft. respectively.

Auxiliary Equipment.

The condensers for the main turbine units are of the Wheeler surface type, the shell being 7 ft. 2 inches diameter, the tubes 10 ft. 2 inches long, and the cooling surface 9,000 square ft., contained in ¾ inch seamless brass tubes. Three Mullin horizontal suction, valveless double-acting crank and fly wheel air pumps running at 105 r.p.m., and developing around 21 h.p. each, on 1,100 lbs .of steam per hour, provide the 2-inch absolute vacuum already referred to, and with a view to the prevention of a total shut-down, through mishap to either of the air pumps, all three draw from the same suction main, and in addition, their capacity is such that any two will maintain the vacuum under maximum load conditions.

The condensers are located in the basement, and have their main axis parallel with that of the turbo-generators. A Cochrane automatic atmospheric relief valve, and an 18-inch exhaust head outside on the roof of the building, provide the atmospheric outlet, should trouble arise with the condenser or pumps.

Three 18-inch, I. P. Morris Co. horizontal, volute type turbine pumps installed in the sub-basement provide the circulating water for the condensers, these pumps being direct connected to 100 h.p., 24-inch, 8 stage, 900 r.p.m. Kerr turbines . The condensing equipment is guaranteed to handle 72,000 lbs. of steam per hour, with 8,000 gals. of circulating water passing every minute at 65 degrees F.

There is also installed in the sub-basement a duplex pump for emptying drainage water, etc., and this unit may be applied, when necessary, to priming the circulating pumps, and to pumping water for flushing out the boilers, etc. Care has been taken in the layout of the main auxiliary equipment that, any two sections of it for a given purpose, are capable of keeping the plant running at its full normal load.

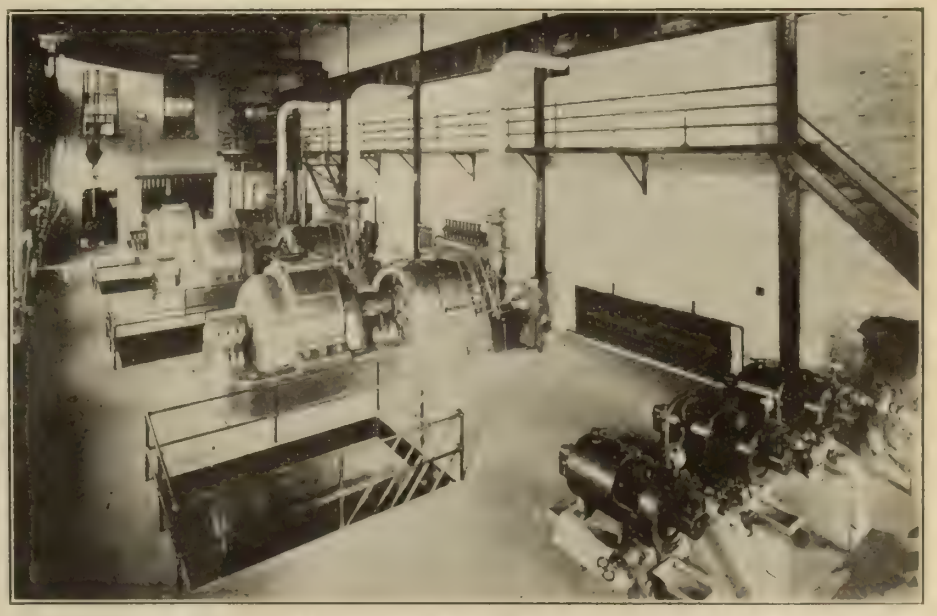


FIG. 6. VIEW OF GENERATOR ROOM WITH TURBINE DRIVEN EXCITERS AT LOWER RIGHT-HAND CORNER, AND SWITCHBOARD GALLERY IN BACKGROUND.

Piping Layout.

The piping layout of a steam power plant is a feature that requires the most careful consideration, and in this particular installation, much attention has been given the various details as will be noted from the provision of ample protection from piping troubles in themselves, and the isolation of piping sections, so that a breakdown of the generation equipment may not affect the whole to the extent of a complete shutdown.

FIG. 7. VIEW OF BOILER FRONT, SHOWING DOUBLE LOOP LINE OF BOILER FEED PIPING AND RONEY STOKERS.

In this plant, the 7 in. connections from each boiler pass through valves into an 8 in. loop main, which, again, is enlarged to a 10-in. header on the side nearest the turbine connections. There is also an 8 in. cross connection along the ceiling of the boiler room from one side of loop to the other, and the main is sectionalized by hydraulicly operated gate valves, so placed that not more than three boilers can be cut out by trouble at any one place. These valves are operated by force pumps located on the boiler room floor. The steam and water mains to the feed pumps and the feed water connections to the boilers are in duplicate so that two pumps are always available for use. All the auxiliaries being non-condensing, their exhaust steam is piped to 2 Worthington high pressure closed vertical heaters, each of which has a heating surface of 450 sq. ft. in ¾ in. tubes, and a capacity of 89,000 lbs. of water per hour from 80 to not less than 205 deg. F. when supplied with not less than 8,500 lbs. of exhaust steam per hour at atmospheric pressure. These heaters were supplied by the Alberger Condenser Co.

The steam line is drained at various points by pipes leading to Bundy tank traps, the water being returned to the hot well. The high pressure piping and part of the high pressure valve equipment were supplied by the Babcock and Wilcox Co., the supplementary high pressure valves and a large part of the low pressure piping, being furnished by the Crane Co., Chicago. In addition to the hot well with its duplicate tanks, there is an L. R. Booth water softening plant of 4,000 gallons per hour capacity installed alongside the hot well.

Switchboard and Lighting.

The switchboard of natural black slate finish is installed on a gallery above the turbine floor, being on a level with the switchboard floor of the main distributing sub-station. A total load panel, 3 turbo-generator panels, 3 exciter panels and a Tirrill regulator panel constitute this feature of the equipment. The total load panel carries ammeters which indicate the steam plant load and the ampere load in the transmission lines from Lac du Bonnet. The turbo-generator panels carry the A. C. ammeters, power factor meter, field ammeter, indicating wattmeter, integrating watt-hour meter, A. C. voltmeter, control switches and indicating lamps for the electrically controlled field switches, the main oil switches, field rheostat, and turbine governor control motor.

The generators are parallelled with the 2200 volt bus-bars of the terminal station through oil circuit-breakers in a switch room adjoining the switchboard. As this room is at the extreme end of the sub-station bus-bars, and it was impossible to increase their capacity, a new set of bus-bars was built from these switches to the bus tie switch of the old structure, where they may be connected,

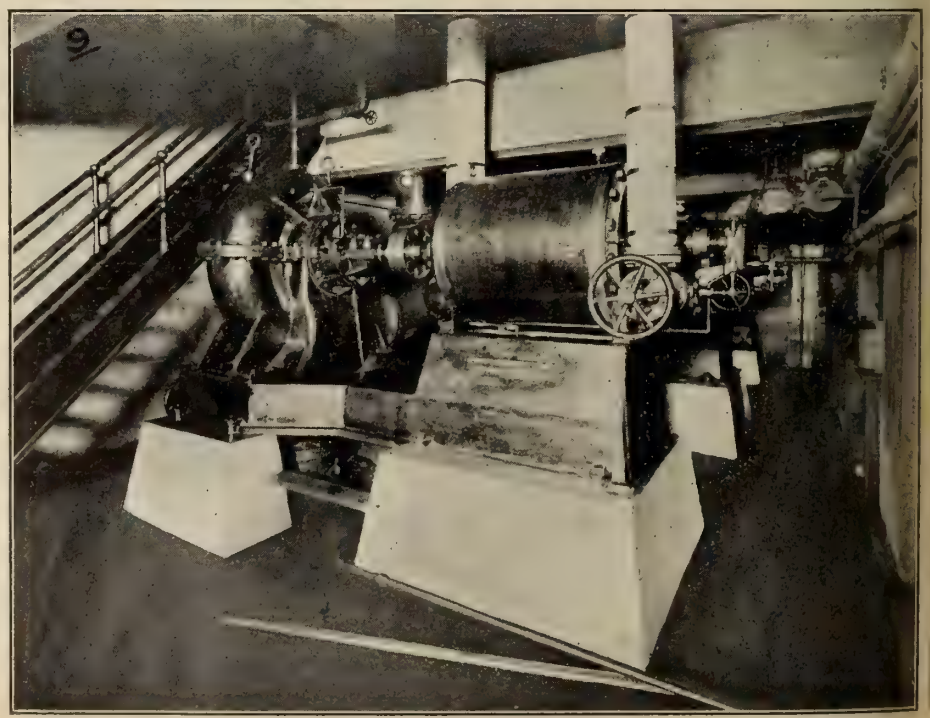
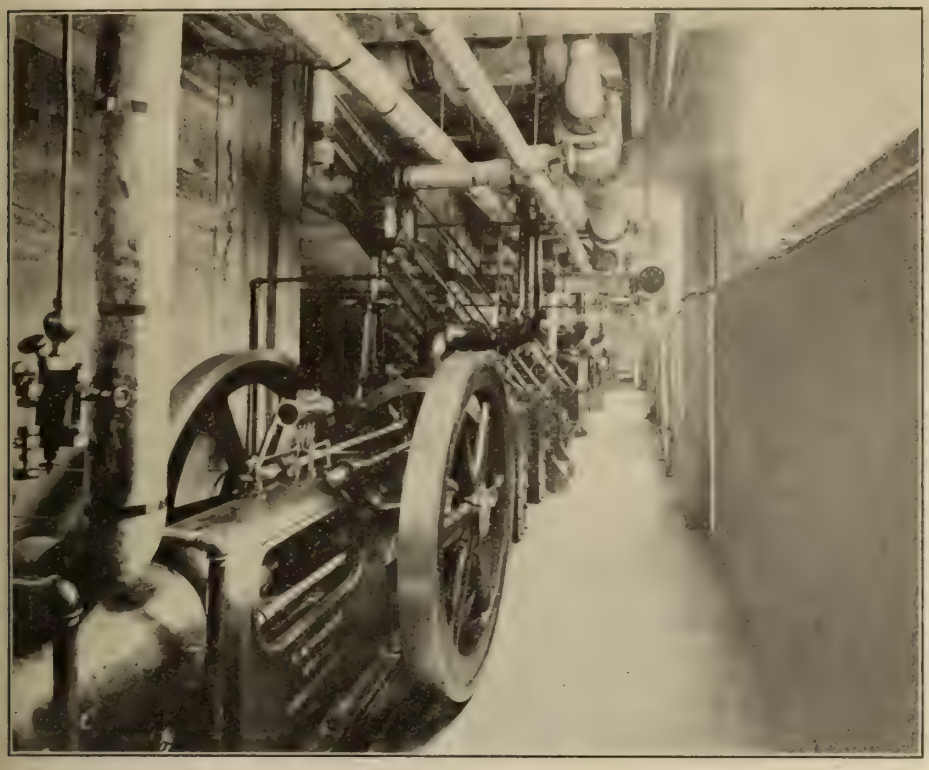


FIG. 8. VIEW OF TURBINE DRIVEN CIRCULATING PUMPS IN SUB-BASEMENT.

by disconnecting switches, to either side of this bue tie switch.

The generators are protected by reverse current relays and over-load inverse time limit relays. Instead of tripping out the oil switches, however, these relays close a loud ringing gong relay which calls the operator's attention to the trouble. Ordinarily, when operating in parallel with Lac du Bonnet, the Tirrill regulator at that station regulates the voltage, and its governors are set so that they take most of the peaks; as a consequence, the voltage curve in the sub-station is very even. The extensive use of synchronous motor-generator sets on the system gives a load on the transmission line of very high power-factor, and the regulation is, therefore, very good.



VIEW OF MULLIN AIR PUMPS IN BASEMENT.

One hundred watt tungsten lamps are used generally for lighting, being mounted on the roof trusses of the turbine room with intensifying shades, and giving a uniform and satisfactory light. Their maintenance is very low. In front of the switchboard, it may be noted that an eight foot "Lin-o-lite" is mounted on pipes which are a part of the railing. This gives a very satisfactory light, it being uniformly distributed on the board, and there is no glare in the floorman's eyes, when watching for signals from the operator. An intercommunicating telephone system is used to connect the various important parts of the two stations.

Building Features.

The foundation proper for the building is of reinforced concrete on tamarack piles driven 45 feet to rock, and cut off below the line of saturation and capped with concrete. Twisted bar reinforcement is used in walls, beams and columns, while the floors are of the arched type with Ferro-inclave reinforcing. The foundations for the turbines, which are of the horizontal type, are carried below the basement floor and do not touch the rest of the building, so that any vibration in the turbines is not likely to be communicated to the floors and other parts of the building. The hot well is also of concrete, and the ash pits are lined with fire brick.

The superstructure is of steel construction, tied in with steel superstructure of the sub-station adjoining. This structure has to carry the 45-ton crane, and in the boiler room the 900-ton coal bin. The exterior walls and partition wall between boiler and turbine rooms are of local brick, while the west wall of the turbine room, and part of the boiler room is formed by the exterior wall of the Terminal Station, into which it opens through archways. The roof slab is also of concrete with Ferro-inclave reinforcing, and, to avoid condensation on the under surface, a double roof is provided with an air space, and a tar and gravel cover. This has proven very satisfactory under severe conditions. The windows are of Fenestra steel sash with wired glass, and all doors are of the fireproof type.

The over-all dimensions of the plant are 121 ft. x 115 ft.; the turbine room is 36 ft. x 114 ft., and the boiler room 81 ft. x 114 ft. Every precaution was taken to make the building and foundations safe and enduring.

General.

Work on the plans for this plant was first commenced in January, 1911, and the first unit was put in operation Dec. 23, 1911. The excellent time made in erection may best be appreciated by those who are familiar with the extremely severe climate conditions existing in the early spring and late fall in Winnipeg, and the difficulty experienced in securing delivery of material on so short notice. The plant has been pronounced by one of the most eminent electrical engineers on the continent as being the best designed and most economical stand-by plant he has inspected.

The consulting engineers were Messrs. Pratt & Ross, and H. Edwards of Winnipeg, under whose direction all of the work of construction was carried on. In the elaboration of the design, details of construction and operation were carefully worked out in conjunction with the officials of the Winnipeg Electric Railway Company, Mr. Wilford Phillips, manager, Mr. Wilson Phillips, general superintendent, and Mr. C. R. Ross, electrical engineer. In addition to the photograph, etc., received from Messrs. Pratt & Ross, we are indebted to an article by Mr. E. A. Graham, published sometime ago in the "Electrical News," for a considerable portion of the data appearing in the present article.

THE FUNCTIONS OF THE TECHNICAL COLLEGE.

By Henry Taylor.

THE idea has recently been put forward that technical colleges should be encouraged to carry out work for manufacturing firms, such work to be done by the college students with the help of an expert staff of workmen. The proper function of the college is to teach the principles which underlie the practice of any trade or profession. No college can turn out men competent to take up responsible positions in commercial firms, and should not attempt to do so. It should aim at training a student's mind, so that, at the conclusion of his college career, he will be able to start his active career in an intelligent manner.

If the college is to carry through work under commercial conditions, there will be no time to explain why a certain process is followed in one case, and another process in another case; if the conditions are commercial, the object must be to push the work through with all expedition, and the students would thus

have to do the laboring and waiting on. The expert workmen would have to work hard to keep up the production of quantity in the necessary time. Any arrangement whereby the quantity of work taken is restricted to that easily managed by the staff of expert workmen and students and to allow time for the reasons at the back of each process being explained, immediately makes the conditions other than commercial. Then, the students must be in at 7 a.m. and work till 6 p.m., and be under the care of a foreman having liberty of expression and disciplinary powers.

Wrong Attitude Apparent

The whole attitude of the technical colleges to the trade is wrong. Time after time I have come across disappointed youths and parents who complain that they were led to send their sons to a technical college from the statements made by the college authorities that there would be no need for the youth to go through the dirty and unpleasant ordeal of the shops if he took the prescribed course at the college, and that he would on the completion of his career as a student be able to obtain a well-paid appointment on the staff of some firm. In the majority of these cases, the youths never settle down to work in earnest, and seem incapable of understanding that to succeed in gaining a leading position requires years of routine work, well and faithfully done. If the staffs of the technical colleges laid it down to the students that the hard, dirty portion of the work must be faced properly and cheerfully, and that they as technically trained men had an immense advantage in starting their shop career with their minds trained to trace out the reasons underlying various processes, the matter would be entirely different.

Even then, however, the method of sending a youth to college before going into the works is a mistake. The plea that the youth, still has the habit of study is not worth anything, as this habit can be kept up at the evening technical school. Whilst the studious youth will require no urging to keep up his studies, the fact must be admitted that at the age when most youths enter a technical college they are not fit to have the full liberty which the colleges permit. They have just come from a tight discipline at the school at which they received their general education, and to the majority of them the freedom allowed is too tempting, and time is wasted. I can take anyone to-day to a certain billiard saloon near a technical college at which students can be found all through the working day idling when they should be attending lectures or demonstrations.

Another point often urged in favor of sending the boy to a college first is that he does not come in contact with the coarse jokes and language of the workmen at so early and so impressionable an age. The idea is founded on the fallacy that the conversation and habits at the college are unimpeachable. I have been a day student as well as an evening student at technical colleges, and from experience know that this idea is utterly wrong. I had heard a good deal of undesirable language and interesting tales at the grammar school before going into the works, and was for a considerable time repulsed from certain workmen by their abominable and lewd conversation. After serving my time and gaining some further experience I proceeded to a technical institution to study as a day student for one year in the branch of engineering in which I intended to specialize. The time wasted by the majority of the students was appalling, and was looked upon by the teaching staff as "Well, it's their own fault, and their own loss." There was a set who regularly frequented a certain first-class bar and considered it due to their personal credit to "down" so many drinks at each sitting, whilst some of the tales and language would have done credit to a forecastle.

Now, when this sort of thing is presented by one's social equals, it is put in a much wittier and more delicate manner than in the workshop, and instead of repulsing by its crudeness, appeals to the sense of humor. The poison is there, and coming in a more attractive guise is ten times more subtle. On one occasion I mentioned this point to a professor in another college to that which I attended, and was met with the remark, "Oh, I don't think so; we have a very decent set of young fellows, and I have never heard anything of the sort." This man was greatly surprised when I asked him if he expected that they would allow him to hear this sort of thing. This opinion only showed how very far away from the real state of things the professor was.

I readily acknowledge the help received from technical training, and wish in no way to deprecate such training; but I do strongly oppose the idea of the colleges attempting to persuade people that their training is a substitute for the works training or able to equip a man in three years for a responsible position. The correct function of the colleges is to teach the underlying principles of the trade, and also the fact that to succeed, hard and monotonous work must be cheerfully faced at first.—Machine Tool Engineer.

READER, WHAT DO YOU KNOW?

Among readers of The Power House there is a clearly defined sincerity of desire to know how each overcomes the daily problems arising out of the care and operation of the power plant. It is believed that your methods of solving these are valuable, and can be made more so, if you publish them, so that other brains may help in the work. We will provide the setting and pay you for the material. When your fellow engineer puts the super-structure on your foundation, we pay him and pass the "kink" on to you, free. Get into the game.

DRIVING BELTS.

DRIVING belts, states a contemporary, often undergo improper treatment. If they fail in their work by slipping over the pulley without driving it, resin is usually resorted to, and while certainly a good help for the time being, it is sure to spoil the belt, making it rough and brittle. In a dusty room, an emery-like mixture is formed by the dust and the resin, which rubs away the belt. Moreover, the adhesion preparations, sold to prevent belt slip, are not always to be recommended, and often contain harmful acids. Care must be taken to avoid putting an unreasonable overload on the shafting, and to see that the pulleys are properly arranged in respect to diameter and distance apart.

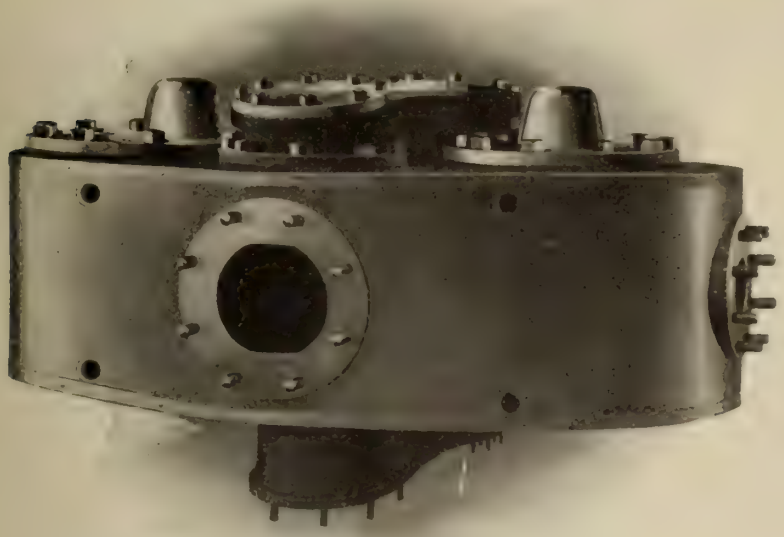
In the case of a new wet-stretched belt, it is advisable to make a careful examination of its structure, especially in respect to flaws, etc. The outer surface should then be thoroughly greased with a mixture of melted tallow and train oil, which should be rubbed in so that it saturates the leather. This imparts, first of all, lasting elasticity and a very high degree of durability, and afterwards keeps the belt pulley in good condition, as the grease permeating the leather is carried over it, leaving a coating which is of such a nature as to ensure almost perfect adhesion to the pulley. When this coating has vanished, which will ordinarily happen in three to four months, the greasing of the belt should be repeated, after it has been well rubbed beforehand with sand paper.

Where the temperature is comparatively high, this fresh treatment becomes necessary more frequently. The use of resin or any strong adhesive substance should be resorted to only in exceptional circumstances.

Features of a Canadian Quick Revolution Steam Engine

The vertical, enclosed, quick revolution, forced lubrication type engine for direct driving of electric generators and other high-speed machinery combines the advantages of small space required, low first cost and maintenance costs, absolute reliability, economy, and simplicity. In recent years, its installation in Canada has been on a large and continuously increasing scale .

THE engines described in this article represent the highest development of the marine type of vertical, enclosed, quick revolution, forced lubrication unit as adapted to land conditions, and its extensive and increasing adoption, the world over, by the British and other Admiralties, the great ocean steamship lines, municipal and other power stations, etc., prove that it has satisfied the requirements of the highest and most exacting authorities. The Goldie & McCulloch Co., Ltd., Galt, Ont., are prepared to manufacture and supply units ranging from 10 to 1,500 horsepower, and suitable for working steam pressures up to 200 pounds per square inch.



CYLINDERS FOR TWO CRANK ENGINE.

Cylinders.

These are cast singly or in pairs, according to size and type of engine, being made of special metal and designed so that they can be completely enclosed in sheet metal secured with polished bands and bright screws. Non-conducting composition is laid on below the cylinder sheeting to a depth of at least 2½ inches. The ports are deep, short and direct, giving free passage for steam, and the valve seats are bored and lapped out to truly cylindrical shape. Escape valves and drain cocks of neat and massive design are fitted on each end of the cylinders and elsewhere as necessary, and connections are made for attachment of indicator cocks and pipes. The top cylinder covers are strong, light castings, fitting into the cylinder counterbore. The interior surfaces are polished, as are also such portions of the outside that are not filled in with non-conducting composition and covered with neat sheet steel ring. In the centre at the top is a screwed brass plug which can be removed for insertion of a lifting bolt for screwing into a tapped hole in the end of the piston rods. This will be found convenient in case of the crosshead pin or crank pin brasses requiring taking up, as the piston and rod and crosshead can be held up from the top and not packed up from inside, thus leaving the mechanic clear space inside which to work.

Valves and Valve Gear.

Owing to the engines being vertical there is practically no wear on the piston valves with which they are fitted.

The steam enters on the inside edges of the valve, and exhausts at the outside; this arrangement keeps the valve spindles and packings working in steam of comparatively low pressure and temperature, thus saving the packings and making the lubrication of the rods more satisfactory, which is specially important with superheated steam. Generally, the valves are simple bobbin shaped castings accurately turned and ground up to fit lapped out seats. In large engines they are fitted with floating rings similar to those described further on in this article for H.P. pistons of smaller engines.

In all compound and triple expansion engines (except for certain special conditions of running) the H.P. valve is under the control of the governor, and is rotated a few degrees on its spindle to vary the point of cut-off, the steaming edges of the valve being at an angle of 45 degs. to correspond with the openings in the valve seat. The cut-off is changed by altering the lap and lead, but the exhaust timing is not affected.

In very large engines the H.P. valve is operated by a relay cylinder, and the

CONNECTING ROD.

work on the governor is further relieved, it only having to operate the small control valve of the relay cylinder. The advantage of this arrangement will be obvious to any engineer. The valves are also all balanced in similar manner to the pistons, and the spindles are of large diameter, giving good rubbing surface and great stiffness, these being essential in high speed work. The bottom ends are fitted with adjustable brasses with large wearing surfaces. Valve covers are light and strong, and the valves can easily be withdrawn by removing the top covers. The bottom covers have deep stuffing boxes, and below these and fixed to the top of the vertical frame, are rigid guides for the spindles, these guides being either brass or babbit bushed, with deep edges to collect any water that may drip down valve spindles, this water being drained off by a system of pipes.

The eccentric straps are of malleable iron, and are lined with babbit secured by key pieces cast in the straps. An oil groove is turned in the babbit and an oil hole leads to this from the crank shaft. The eccentrics are also of malleable iron, and secured to crank shaft by steel keys and screws. They are in halves and easily removable. On one of the eccentric straps, lugs are cast, and a pin fixed for driving the forced lubrication pump. The eccentric rods are stiff short steel forgings machined all over, and drilled up the centre to carry oil from the eccentrics to the valve spindle pins, which are of hardened steel ground accurately to size. These rods are secured to palms on the eccentric straps by studs and locking pins.

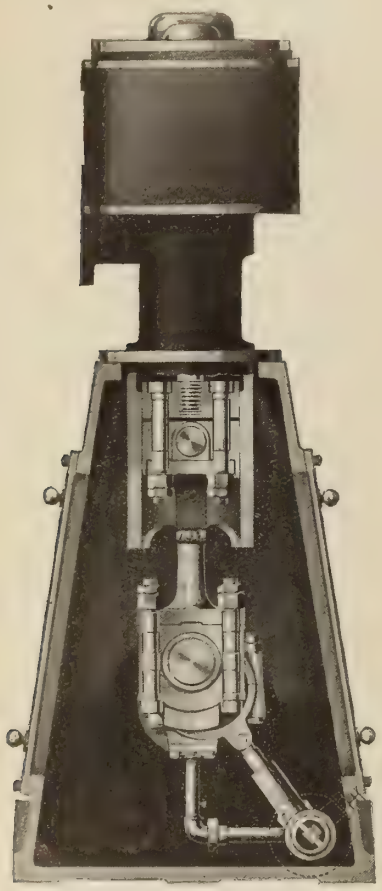
Throttle Valve.

The throttle valve consists of a cylindrical chamber with a flanged branch bolting on to the H.P. cylinder. The valve is of cast iron, of the double ported piston type, working on the outside of a cast iron sleeve seat, both valve and seat being ground accurately steam-tight, and the design is such that there is no tendency to distortion, due to varying temperatures of steam, being specially suited for working with superheated steam. The steaming edges of valve and seat are dressed perfectly parallel, and the valve with its spindle and rod weigh only a few pounds even in large sized engines. The spindle is of Muntz metal working in a long frictionless brass sleeve, no packing being used, leakage grooves being turned in the spindle which is a ground fit for the sleeve. The bottom end of the spindle has a pin joint, the bottom half forming also a small drip dish, which collects any water that may leak past the spindle, and this dish is screwed into the hollow governor rod, which carries the water down to a small drain box and prevents unsightly or messy water dripping about the engine.

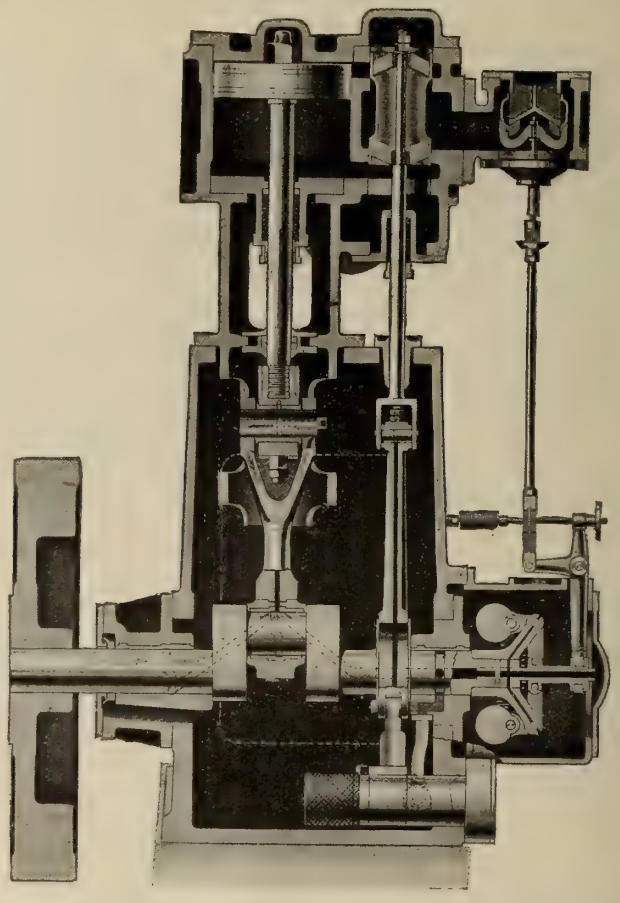
Pistons, Rods and Rings.

The low pressure pistons are of marine type, being coned shells of great strength and lightness, and made of either cast or forged steel, according to size. They are turned and polished all over, and fitted with "Rowan's" packing rings. These rings are also fitted to the H.P. pistons of the larger engines, and in cases where superheated steam is used, have a restraining tongue piece to prevent them expanding beyond a predetermined amount. In the single cylinder engines, and smaller twin and compound engines, a deep solid cast iron "floating" ring is used, accurately ground to size. This ring has "labyrinth" grooves turned on the outer face which serve to retain oil, assist lubrication, and prevent steam passing.

The H.P. piston for either this ring or the "Rowan's" type is a coned cast iron block in two pieces, and polished all over. The H.P. piston in compound engines is exactly the same weight as is the L.P. piston, although of different diameter. They are weighed separately with their corresponding rings, piston and connecting rods, and the difference

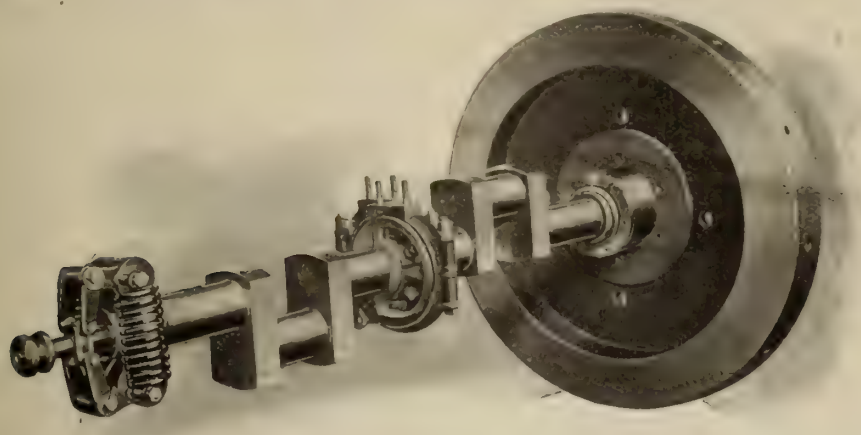


END VIEW OF SINGLE CYLINDER ENGINE.



SECTIONAL FRONT VIEW OF SINGLE CYLINDER ENGINE.

in the weight is turned out of the inside of the two halves of the H.P. piston, which is cast purposely a little heavier than the L.P., to allow for any inaccuracy in balance being corrected before assembling. In three crank engines, the pistons, etc., are balanced in a similar manner to the two crank.



CRANK SHAFT FOR 2-CYLINDER ENGINE, SHOWING GOVERNOR MECHANISM, ECCENTRIC AND FLYWHEEL.

The rods are of special steel, accurately turned and ground to correct diameter, and secured to the pistons by deep nuts with locking pins. The pins for the crosshead brasses are suitably drilled for oil circulation, as are also the crosshead shoes. In very large engines, the crosshead shoes have a further supply of oil brought to the back of the guide by piping.

Connecting Rods.

The connecting rods are of marine pattern, being short steel forgings with brass bushes lined with babbit for the crank pin end, and hard brass or bronze bushes for the crosshead pins. The crank pin bushes have oil channels same as in crank bearings, and the babbit is securely dovetailed in place. All bolts are fitted ,and have lock nuts and safety pins. The connecting rod is also drilled to carry oil from the crank shaft to the crosshead pins.

Distance Pieces.

The distance pieces consist of strong, short circular castings, mounted on top of the vertical frame, and extended down into the inside of same to form crosshead guides, which are circular in form. The top ends form the bottom covers of cylinders, and the inner surface is polished. The piston rod stuffing boxes are also formed in these castings, as are also recesses for the wiper packings, and as the part which enters the cylinder is turned to fit the cylinder counter bore, absolute accuracy of alignment is secured. Openings are formed in the portion above the vertical frame for access to piston rod stuffing boxes, and the joint between bottom flange of distance pieces and top of frame is made oil tight. The space between the steam packings and the wiper packings on the piston rods is never less than the stroke of the engine, thus preventing the rubbing portions of the rods working in two different types of packing, and likewise hindering the crank case oil passing up with the rod into the cylinder and forming ridges of charred oil on the rods, as frequently happens when the distance between the two packings is less than the stroke. All joints are formed on external flanges, thus giving easy access to all nuts and studs, and insuring a steam tight joint at the cylinder.

Vertical Frame.

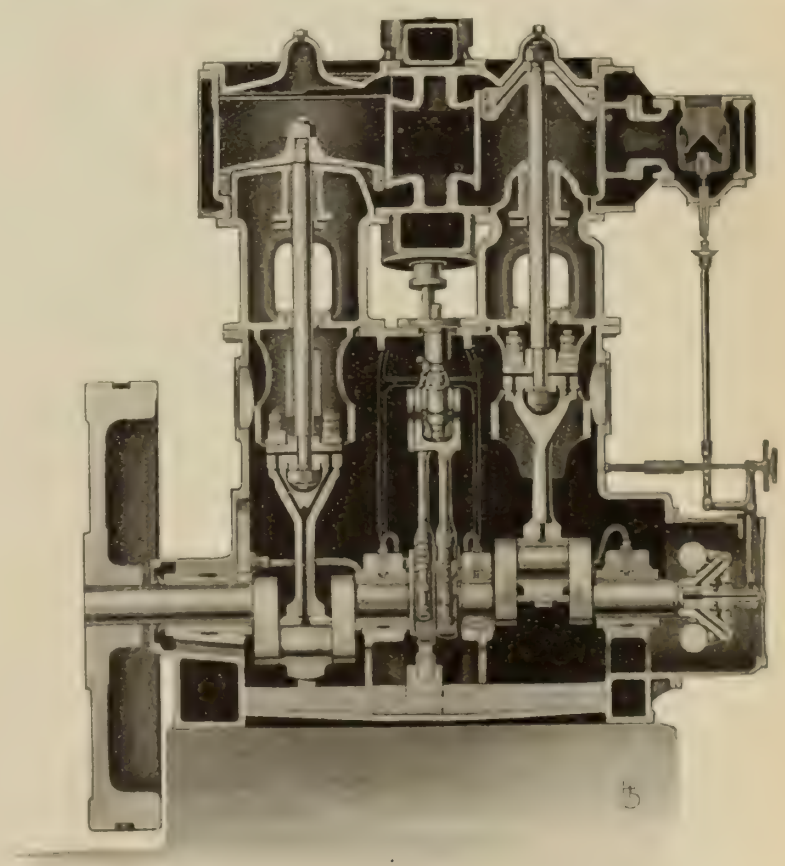
The vertical frame is of rigid design and pleasing appearance, and has large doors for access to and examination of the enclosed portions of the engine. All faces are machined and all joints are made oil tight; openings are formed in the top to receive the cylinder supports and the valve spindle guides; there are also openings in the back side with facings for attachment of indicating gear. The vertical frame is dressed, cleaned and varnished inside.

Bed Plate.

The bed plate is of strong and rigid box girder construction, with bottom cast-in solid, to form a tank to contain the forced lubrication pump and its oil supply. A drain cock to run off the oil, for cleaning or renewal; light doors for examination of the oil pump, relief valve, and oil strainer are also fitted.

Crank Shaft.

The crank shaft is a solid steel forging, and the short throw and thick crank webs, also the manner in which the shaft is supported with a bearing close to each web, give great stiffness and strength. An oil supply is carried to each crank shaft bearing, and from thence by suitable passages to the eccen-



SECTIONAL FRONT VIEW OF TWO-CYLINDER COMPOUND ENGINE.

tries and crank pins from which it is further distributed as necessary. The outer end next the flywheel is increased in diameter, and has an extra long bearing.

Flywheel.

The flywheel is cast in one piece, as is necessary owing to the high peripheral speeds. It is of the solid plate type, turned all over for balance, polished on rim, and is forced and keyed on to the shaft. The outer face is made to form a coupling for the end of a generator, fan, centrifugal pump, or other shaft.

The barring lever for the smaller engines is so designed that with the stop valve slightly open when starting the engine, and it starts off quickly, the lever disengages itself, and remains in the engineer's hand. In the larger engines a bracket with a pawl and long removable lever is supplied.

Governor.

The governor casing is a cylindrical box spigotted into the end of the bed plate and vertical frame, and secured to same with an oil tight joint. A large circular cover on the front end, which can be removed whilst the engine is running, gives easy access to all parts.

The governor is of the centrifugal spring loaded type, mounted directly on the crank shaft. The weight carrier or fork is a malleable casting, and the weights are of the same material, formed at the ends of a pair of bell crank levers. The carrying pins are of large surface, and are under forced lubrication, the centrifugal pull of the weights being taken directly by the main springs, the ends of which hook over pins in the weights. There is thus practically no force being exerted on the point of suspension (the carrying pins), except that due to the weight of the throttle valve, etc. The inner ends of the bell crank levers carry large pins engaging in the collar of a steel sliding sleeve, this sleeve working on a small spindle carried in the crank shaft and drilled for oil circulation; the outer end of the sleeve has also a collar engaging with the bottom of the governor lever, this also being lubricated under pressure. The governor lever extends to the outside of the casing and is secured to a small shaft, the ends of which rest on pin point suspension to minimise friction. The bottom end of the throttle valve rod is attached to this lever, as is also an auxiliary spring and small handwheel by means of which the speed can be varied whilst running within certain limits. When the H.P. valve is of the expansion type, a second lever is attached to the small shaft and carries a buffer spring box attached to the expansion gear rod.

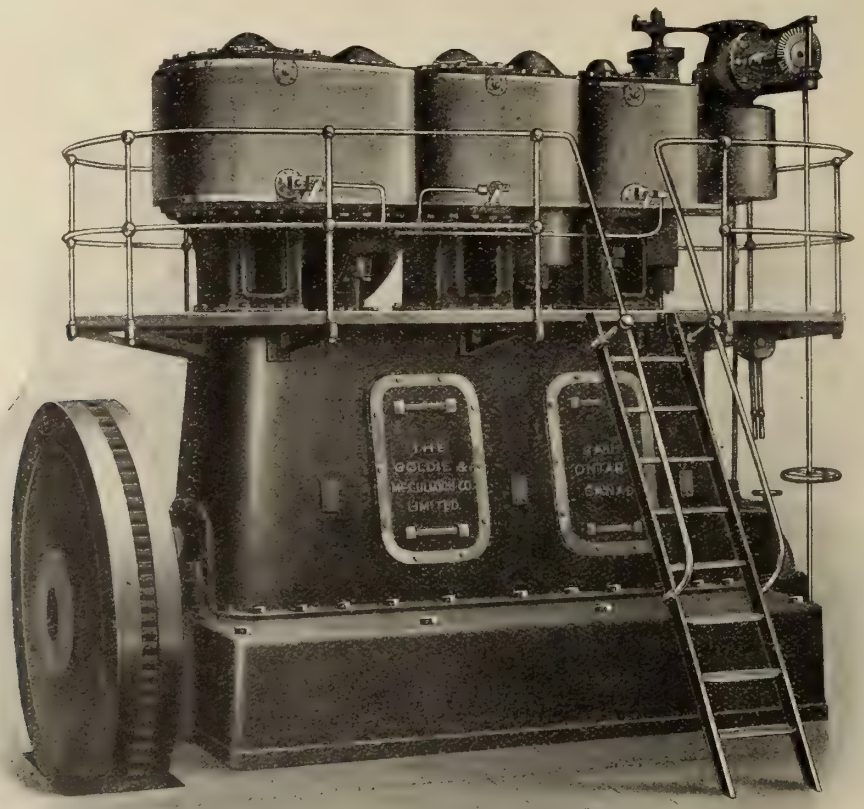
Crank Shaft Bearings.

The crank shaft bearings are strong cast iron bushes, lined with best quality of babbitt secured by locking grooves which run lengthwise and crosswise in the shells. The shells are turned on the outside and the engine bed is bored to suit. The babbitt is grooved with circular channels for the oil supply, the oil entering through a pipe screwed into the top shell, and passing through the cap.

In compound and twin cylinder engines, there are four bearings, and in three crank engines (compound or triple), there are six, thus giving a bearing close up to each side of the crank webs . The bearing next the flywheel is larger in the bore and longer than any of the others, and the cap is made with oil tight joints and fitted on the outside with oil cover and thrower to prevent oil escaping.

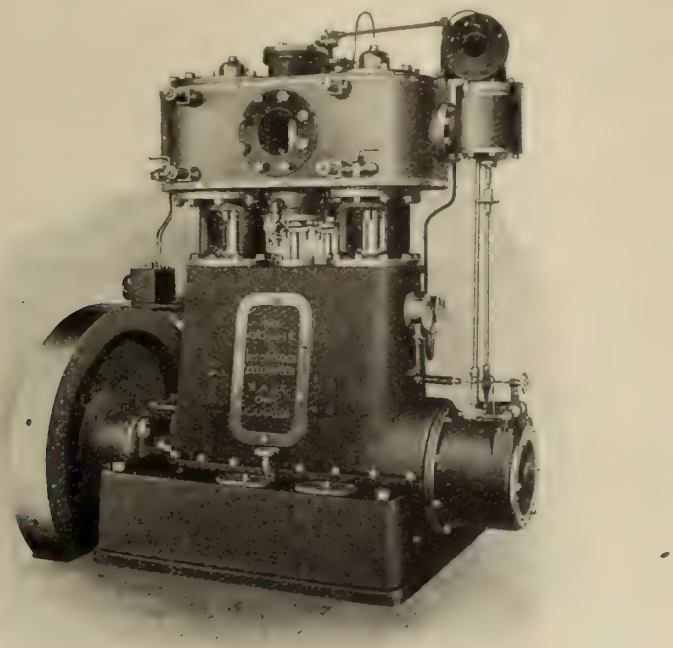
Oil Pump.

A special feature of these engines is the pump for supplying the oil under pressure to the various bearings. At high speeds of rotation, ordinary valves will not act, and the pump has therefore to be designed to work without valves. The oil pump consists of only 3 parts, a casing, an oscillating plug, and a plunger. In the casing are the suction and discharge chambers, each communicating



THREE-CYLINDER COMPOUND TRIPLE EXPANSION ENGINE.

by a single rectangular port with a circular chamber which is bored out to receive the oscillating plug. The plug is turned to fit this chamber and has a hollow lower half, in which is a single rectangular port. A small steel barrel is secured into the upper half of the plug, and, in this the brass plunger is worked up and down by the eccentric. At the same time, the eccentric imparts an oscillatory motion to the plug, alternately bringing the port in the plug opposite the suction and discharge ports in the casing. A spring loaded relief valve, for regulating the oil pressure, is under control of the engine attendant by means of a small spindle with handwheel passing to the outside of the engine bed, a small gauge indicating the pressure.



BACK VIEW OF COMPOUND TWO-CYLINDER ENGINE.

Fitting close on to the suction chamber of the oil pump is a strainer of perforated metal, with fine mesh brass gauze, clipped on. The sheet metal is soldered to brass ends, one of these having a balled face to find its own seating in a corresponding socket on the pump. A spring at the back end of the strainer presses it close to the pump, and by lifting a small cover in the engine bed, and pressing back the spring, the strainer can be removed for inspection and cleaning. The oil is carried by piping from the discharge chamber to each crank bearing, and is further distributed from these throughout the engine.

Oil and Water Separator.

As water getting into the oil in the engine bed would cause trouble and waste, an automatic oil and water separator is fixed on the engine bed and connected by pipes inside the vertical frame to the cylinder distance pieces and valve spindle guides. Cylinder oil and water that may come down the piston and valve rods, and any crank case oil that may work up, are collected by suitable wiper packings in the distance pieces, etc., passed down the pipes to the separator, which automatically separates the oil and water, returning the first to the engine bed, and allowing the water to escape by a suitable drain.

Balancing.

Under all ordinary circumstances, balance weights are not required as each line of similar moving parts is exactly the same weight, and the distance between the crank centres is very short. In special cases, balance weights are sometimes fitted, the size and angular position of same being carefully determined to ensure the maximum possible reduction in both unbalanced forces and couples. In single crank engines, balance weights are employed, and in the smaller sizes, these are formed out of portions of the crank webs.

Warming Up Valves and Drain Pipes.

In larger engines, auxiliary warming and starting valves are fitted so that the cylinders can be thoroughly warmed up and the engine easily started. The gear for operating these is placed close to the main steam valve. In large engines, the cylinder drain cocks are operated by means of a lever or levers placed convenient to the starting point, and neat wrought iron platforms, ladders and handrails are fitted where necessary to give access to all parts of the engine.

THE COMING C.A.S.E. CONVENTION.

REPORTS from C.A.S.E. Lodge 25, Owen Sound, Ont., indicate that preparations for the coming Convention of Stationary Engineers are well in hand. The individual members of the local body have entered heartily into and worked harmoniously to make the gathering on July 29, 30 and 31 the most successful of the many previously held, and operating engineers should, if at all possible, lay plans to take in the gala time that the fraternity, backed by the public of Owen Sound, are providing. The souvenir, we understand, is again a record beater. Provision has been made for the ample housing and display of engineers' supplies, which the Exhibitors' Association from year to year take the opportunity of bringing directly to the notice of the engineers, and we have no doubt that the former high standard attainment, reached in this direction, will also be surpassed.

SAWMILL WRECKED.

AN explosion occurred at the sawmill at Stewartown which completely wrecked the building. Four men were inside the mill at the time and Walter Lawson, the owner, had just left the boiler room less than a minute before the boiler exploded. William Bescoby was blown out of the building, but fortunately was uninjured. The saw operator was knocked down and slightly injured, and two other men were pinned down beneath some timbers, both, however, escaping practically unhurt. William Thompson, driving along the road, had pieces of the wreckage come perilously near to him, his rig being struck. A portion of the boiler, weighing half a ton, was carried three hundred yards. It is a miracle that no person was killed, as the building is a total wreck.

James Howden & Co., Engineers, Glasgow, Scotland, who are represented in Canada, by F. L. B. Heward, 186 Mansfield street, Montreal, report the following equipment recently ordered: Edmonton, Alta.—One 100 k.w. standard two crank, compound, high speed engine to run at 500 r.p.m. on 140 pounds steam pressure, and exhausting into the atmosphere, for steam driven exciter set. Other installations include two engines for the Canada Iron Corporation, Midland; one for the Robert Simpson Co., Toronto; one for the Montreal General Hospital, and one for Nanaimo, B.C. Steam turbines and water tube boilers are other features of the firm's product.

Purchase of Coal and the Sampling of Coal Deliveries

Increased attention is now being given the questions of coal purchase and delivery sampling, first of all with a view to securing the most suitable grade for a particular equipment, and, second to ensure that it conforms to that specified. The U.S. Bureau of Mines have devoted much time and money towards bringing the matter prominently t othe notice of steam users.

LARGE users of coal will be interested in Bureau of Mines Bulletin No. 63, "Sampling of Coal Deliveries, and Types of Government Specifications for the Purchase of Coal," which has recently been issued. The Federal Government, which purchases $8,000,000 worth of coal annually, buys more than half of it under specifications, and has gone deeply into the question of sampling and analysing coal. George S. Pope, the engineer in charge of such investigations and the author of the bulletin makes the following statements:

To determine with the utmost accuracy, the ash content and heating value of a quantity of delivered coal would require the burning of the entire quantity, and special apparatus arranged to measure the total heat liberated, or would require crushing the whole quantity, and reducing it by an elaborate scheme of successive crushings, mixings, and fractional selections to portions weighing approximately 1 gram, the minute quantity which the chemist requires for each determination. Either of these procedures is obviously impracticable, if the coal is to be used for the production of heat and power. The method actually employed is to select portions from all parts of a consignment or delivery of coal, and to systematically reduce the gross sample, obtained by mixing these portions, to quantities that the chemist requires for making ash determinations or that can be burned conveniently in the calorimeter, an apparatus for determining the heating value. The gross sample should be so large that the chance admixture of pieces of slate, bone, coal, pyrite, or other impurities in an otherwise representative sample will affect but slightly the final results. Increasing the size of the gross sample tends toward accuracy, but the possible increase is limited by the cost of collection and reduction. In reducing the gross sample by successive crushings and halvings or fractional selections, the object is to procure a small laboratory sample that, upon analysis, will give approximately the same results as the gross sample itself, or, in fact, the entire quantity of coal from which the gross sample was obtained.

Wide Variety of Conditions.

Recognizing the importance of the method of sampling as being a definite commercial procedure, and of having the method clearly set forth in the specifications to become a part of the contract, and recognizing also the desirability of insuring uniformity and similarity in the specifications used by the different branches of the Federal service for the purchase of coal, representatives of the executive departments and independent establishments of the Government held a conference under the auspices of the Bureau of Mines in February, 1912, for the purpose of discussing these and other features of the specifications. At this conference committees were appointed to prepare specifications in accordance with the views of the members. It was recognized at the conference that in general specifications, such as were recommended, certain requirements had to be of wide application, as the specifications cover such a wide variety of conditions, not only as to character and quality of coal but as to type of furnace equipment, size of deliveries, methods of delivering, etc.

B.t.u. "As Received" Basis.

The specifications which were used for the purchase of coal on the heat-unit basis prior to the fiscal year 1912-13 were on the B.t.u. (British thermal unit) "as received" basis; that is, payment for delivered coal was directly affected by the moisture content of the sample received by the laboratory. This method was based on the assumption that the moisture in the samples collected at the time of weighing and delivery could be preserved with slight loss during the storing and subsequent working down of the gross sample to a quantity convenient for transmittal to the laboratory and in its later treatment in the laboratory. From experiments that have been made and from a large mass of data, it is known that the moisture content reported by the laboratory may be as much as 5 to 10 per cent. lower than that actually contained in excessively wet or high-moisture coal at the time of weighing.

As a sample loses moisture, its B.t.u. "as received" value correspondingly rises, with the result that the price for delivered coal determined on the "as received" value is, with rare exceptions, higher than that warranted by the quality of the coal at the time of weighing. As a general statement, payment based on the "as received" B.t.u. value will be higher than warranted, unless the sampling and laboratory work can be carried on under conditions that minimize moisture loss, as under freezing temperatures. Recognizing the uncertainty involved in taking the moisture determination in the laboratory as representative of the moisture content of the delivered coal and the consequent possibility of payment of a higher price than is warranted, the Bureau of Mines recommended to the executive departments and independent establishments of the Federal service that the heating value in the coal specifications for the fiscal year 1912-13 be on the "dry coal" basis.

Moisture Feature.

In preparing these specifications, the fact was recognized that the amount of moisture contained in coal produced from day to day from the same mine, or group of mines working the same bed, is largely accidental, and is a matter over which the buyer and seller have only slight control. However, in order to place a negative value on high moisture coals, and to protect the Government against the delivery of coals containing excessive amounts of moisture, the specifications require the bidders to specify the maximum moisture content in coal offered. This value becomes the standard of the contract. If coal of uniform B.t.u. "dry coal" value is delivered on a contract, the contractor receives the advantage on any delivery in which the moisture content approaches the maximum specified, because he is paid for the weight of water contained in the coal in excess of a normal amount, whereas if the coal is very dry, containing less than the normal amount of moisture, the purchaser receives the advantage.

As an example of the effect of a heavy rain on a car of coal in transit a precipitation of 3 inches of water on a loaded 50-ton car, area of top about 360 square feet, would increase the weight of the coal 5.01 per cent., provided none of the water drained out or evaporated. It is obvious that if this coal is weighed and delivered immediately, special samples for moisture determinations should be collected and prepared at once and sent to the laboratory as a basis for equitable adjustment of payment on account of the excessive amount of water in the coal. As the weight of the coal was increased by the excess water, there should be a corresponding decrease in the price to be paid. If a railroad car or wagon so rained on should not be unloaded immediately after weighing, and special moisture samples should not be properly collected, prepared, and sent hermetically sealed to the laboratory, it is obvious that the purchaser would pay a higher price than warrant-

ed, especially if the car or wagon stood for some time before sampling and some of the water drained out. Further, if the coal was not immediately unloaded and sampled or if the car continued in transit after weighing, then the coal at the top would soon dry; and in either case the effect of the 3-inch rainfall, as indicated by the analysis, might be only a fractional percentage of the moisture contained in the coal at the time of weighing. The determination of the moisture of coal delivered from stock piles is often of great importance, for the proportion of moisture contained in the small sizes, which are most abundant near the centre of a stock pile and which absorb the rains and melting snows in districts of heavy snows, may be from 10 to 15 per cent. higher than when stocked. It is apparent, therefore, that special moisture sample determinations are necessary for equitable adjustment of payment on amount of excessive moisture in coal which is stocked in piles exposed to the weather.

The specifications provide for the collection of "special moisture samples" if, in the opinion of the Government officials sampling it, the delivery contains moisture in excess of that guaranteed by the contractor. The "special moisture samples" are prepared in a manner to minimize moisture losses, and may be taken and prepared independently of the gross samples collected for the determinations of heating value (B.t.u.), ash and other specified data. If the analysis of the special sample shows a moisture content in excess of the contractor's guaranty, a proportionate deduction is made from the price to be paid for the coal. Copies of this bulletin may be obtained by addressing the Director, Bureau of Mines, Washington, D.C.

British Board of Trade Steam Explosion Records

Most searching investigations are made in Great Britain, with a view to locating the cause and fixing the blame, arising from steam explosions due to the failure of the vessel or container. The data given forms highly instructive reading for all connected with the business of steam engineering.

A CAST iron pipe, about 6 ft. long by 6 ft. bore, forming part of the connection between the boiler and the superheater, exploded while under a steam pressure of 160 lbs. About half the pipe was broken into several pieces, the remainder being in one piece for nearly the whole length. The explosion was caused by water-hammer action brought about by admitting steam to the steam pipe range in which water of condensation had accumulated, no provision having been made for draining the system. The casting at the fracture varied from 11-16 to 14-16, and was a good casting, though a small part was spongy. The explosion occurred at a flour mill, no one being injured.

Vertical Boiler Fire-Box.

A formal investigation was held concerning the explosion of a vertical type, iron boiler, with an upright fire-box, the property of the Port of London Authority. Five men were injured (one only slightly), and all have recovered. The boiler's age was unknown, although it was "not new in 1893." The cause of the explosion was overheating of the crown plate owing to shortness of water. The crown of the fire-box had been subjected to heat, and was forced down into the fire-box. The steam and water escaped through the opening thus made. The boiler fittings were not in proper working order, the crane-driver in charge not having taken proper measures to ensure that the boiler was properly fed. The Commissioners made severe comments on the "unsatisfactory evidence," and report that the metal was reduced by about 3-16 inch, but was still of ample strength. The explosion blew the boiler 300 feet away, where it dropped through a shed. The fittings were in an unsatisfactory condition through incompetent care; some few months previously they had been overhauled and left in a satisfactory state.

Water Tube.

A water tube exploded under a pressure of 160 lbs. in a boiler made by Babcock & Wilcox and installed in 1893. The tube which failed was stated to have been one of the original tubes, and was, therefore, about 19 years old. Records of various repairs were kept, and about four months before the explosion the boiler was tested by hydraulic pressure to 230 lbs. The works manager had examined the boiler externally and internally three months before the explosion. The tube was the fourth from the left-hand side in the seventh row from the bottom; it ruptured close to the back header, being completely severed. On being removed, it was found that for a length of about 10 inches from the back header, external corrosion and erosion had wasted it to paper thickness, and other tubes were found to be similarly wasted. The boiler was only used intermittently for testing purposes, which, in the inspector's opinion, was the primary cause of the corrosion. When full of cold water the tubes would sweat, and this, with the particles of ash passing round the outside of the tube, would reduce it in thickness until it was not able to withstand the pressure. The boiler man was burned on the arms, but has recovered. The explosion occurred at Caird & Rayner's, Commercial Road, London.

Marine Boiler Fire-box.

An explosion occurred on the steamship Gothic when 355 miles E.S.E. of Durban, Natal, S.A. No one was injured. The boiler was made by Harland & Wolff, and was nineteen years old. In the previous July it was thoroughly examined and found satisfactory. An inquiry was held by Mr. Henry J. Vose, for the Board of Trade, on the return of the vessel. The crown plate of the port wing combustion chamber collapsed, forcing the nuts off the whole of the fifteen 1½ inch stays which supported the plate. The steam and water from the boiler escaped through the 15 holes in the plate, going chiefly through the smoke-tubes and uptake to the funnel. The flanges of the back tube plate and the combustion chamber were set down, and the holes for the two top rows of tubes were flattened down, otherwise the boiler appears not to have received damage as a result of the explosion. The opinion was expressed that the explosion was due to overheating caused by shortness of water, and the bulging of the plate between the stay holes and the stripping of the nuts might be expected from the water level being allowed to fall below the crown plate of the combustion chamber. The engineers were, however, working under very difficult conditions, owing to their having to devote a good deal of attention to the men in the stokehold, which was manned by "indifferent firemen." The various parts of the boiler showed no sign of wasting, and appeared to be practically in their original condition.

Welded Repair.

An explosion occurred through the failure of a welded repair on the furnace of the s.s. Kelvingrove when 96 miles from Cape St. Vincent. Inquiries made show that the boiler is the usual single-ended cylindrical multitubular marine type, 11 ft. 6 in. long and 14 ft. 6 in. mean diameter, of steel, with three Morison suspension furnaces of the cone-necked type, each 3 ft. 7 in. internal diameter, and 9-16 in. thick. It was thirteen years old. In 1903 three new furnaces were supplied by the Leeds Forge Co. Owing to a defect in

the welding at the back end of the centre furnace, then observed, it was taken out and returned to the makers, who repaired it by welding in a "glut piece," and after it had again been fitted, the boiler stood a hydraulic test of 180 ibs. per square inch satisfactorily. At various times small cracks have developed in the furnaces, above the line of fire-bars, and these have been repaired by fitting screwed interlocking pins. The inspection and care was satisfactory. In the explosion a portion of the bottom of the conical neck of the centre furnace in way of the weld was blown out, leaving an irregular hole about 1 foot wide and 2¾ inches long, through which the contents of the boiler were discharged into the stokehold, the pressure at the time being 160 lb. per sq. in. A fireman was slightly scalded on the right foot. The explosion appears to have been due to a want of homogeneity in the welding of the "glut" piece, and, owing to corrosive and mechanical action, the part had become unfit to withstand a pressure of 160 lb. per sq. in. This method of repairing slight defects in the welds of new furnaces usually gives satisfactory results, but in this instance the welding of the "glut piece" does not appear to have been efficient, as shortly after the furnace was put to work it was observed that the weld was not effective through the full thickness of the plate, and although the furnace had frequently been examined afterwards, and the defect was seen to have extended, it was not thought to be serious.

CLEANING GAUGE GLASSES.

CLOSE the upper and lower valves and open the pet cock to empty the gauge glass of water. Hold a cup or other suitable receptacle containing muriatic acid of ordinary strength under the pet cock. Open the lower valve sufficiently to cause the acid to be drawn to the top of the glass. The alternate opening of the lower and upper valve causes the acid to be drawn up and repelled. Two or three applications will clean a dirty glass thoroughly.—Exchange.

William Hunt, assistant engineer at Peterborough city water works pumping station, was presented with a handsome chair by the officials and engineers of the works, on Thursday, June 5th, on the occasion of his marriage.

Concerning Water Hammer and Resulting Explosions

Water hammer is more or less an accompaniment of every steam power plant, being more aggravated in its effect in some than in others. To counteract or minimize its effects in all cases, requires careful and skilful treatment by the engineer operator.

IN a British Board of Trade investigation into an explosion which occurred on board the R.M.S.P. Co.'s steamship "Araguaya," while she lay in dock at Southampton, through which three men were killed and several others severely injured, the Commissioners were unanimous in their conclusion that the explosion was due to water hammer. The explosion took place in a stop valve chest through the accidental opening of a drain cock. Only three days previously, the stop valve chest which failed had been tested hydraulically, under suitable supervision, to a pressure of over twice that at which it worked, the pressure being maintained for about an hour.

Conditions Favorable to Water Hammer.

P. J. Haler and A. H. Stuart, in an article appearing in the "Machine Tool Engineer," say that in view of the frequency of accidents of this type, it may be well to consider the various conditions which may lead to water-hammer action. The most readily understood example is that of a long line of pipe carrying water. If a valve in this line is suddenly closed, it is easily seen that this action is an attempt to bring to rest a great weight of water possessing considerable velocity. The energy must go somewhere and since the compressibility of water is extremely small it delivers a blow to the stop valve, which usually fails to withstand the shock.

Most serious accidents which arise through water-hammer action, however, occur in steam pipes, and for the action to be set up, the first condition is that water and steam be present in the pipe; but the mere presence of water and steam does not mean that water hammer will result. The extra conditions known to have prevailed in cases where explosions have occurred are:—

(1)—The example most closely allied to the hydraulic one mentioned above is that in which a plug of water has collected in a steam pipe. This may happen as a result of condensation of the steam, or it may be due to a boiler priming. When the engine stop valve is opened, the steam passing along the pipe will carry the plug of water with it. If the steam range is a long one, the water will acquire a considerable velocity as the engine gets up its speed, and when an elbow occurs in the pipe, as, for example, at a stop valve, the water possesses too much momentum to change its direction so rapidly, and a blow is accordingly delivered to the side of the valve chest.

(2)—Suppose during the inactivity of an engine, steam has condensed, and the water so formed has collected in some low-lying portion of the steam range. It occasionally happens that the drain cock is opened while the range is under steam pressure. This operation will remove some of the water from a portion of the pipe which was probably full, and thus a long surface of comparatively cold water is exposed to steam in the upper part of the pipe. As a result, large quantities of steam are condensed, and the consequent inrush of steam will raise waves on the surface of the water, and these will isolate a quantity of steam from that which follows. This entrapped portion condensing, produces a vacuum, into which the water shoots with great violence, thereby delivering a water-hammer blow. In many cases, this shock is sufficient to fracture the pipe at the point where the blow is delivered, but in other cases the pressure wave is transmitted along the pipe to do damage elsewhere, usually at a blank end, where its force will be doubled by reflection.

(3)—Very similar to these conditions are cases in which steam has been admitted to pipes which contain water, and others in which water has been admitted to (as in over-heated economizers) or formed by condensation in (as in cold ranges) pipes containing steam.

(4)—Several examples are on record where water hammer has resulted from the opening of a valve when there has been steam pressure on both sides of it, and water on at least one side. This may happen where there is a main under steam pressure, and steam is being raised in a boiler which has been out of use.

(5)—In long and complicated systems of piping, cases are known where the flow of steam has dammed up water in unused portions of the range. A fall in the velocity of the steam would release this imprisoned water, and conditions similar to those mentioned in examples (1) or (2) might be produced.

Possible Precautions.

Summing up briefly, the possible precautions which may be taken to avoid water-hammer action, in the case of a single boiler and a single engine, the junction valve should be at the highest point of the range, and the steam conveyed to the engine along a horizontal

pipe. With two or more boilers, or two or more engines comes the danger of the flowing steam damming up water as in example (5). If a horizontal steam pipe rises after it leaves the boiler junction, the water may collect in the pocket, and if the pipe falls and then continues horizontally to the engine, water may collect near the engine stop valve. It is desirable that all pockets be fitted with water catchers having water gauges and automatic drains. Drain cocks on steam pipes, although a necessity, are a source of great danger, unless they are very carefully attended. If left partly open, they are liable to become choked, and if opened occasionally, they may produce the conditions set out in example (2).

HEAT ACCUMULATORS IN EXHAUST STEAM TURBINE PLANTS.

A PAPER was recently read before the Junior Institution of Engineers by Mr. Archibald Alison on "Heat Accumulators and their Use in Exhaust Steam Turbine Plants." The author commenced by emphasising the superiority of the condensing engine over the non-condensing, and drew attention to the excellent combination obtained by the use of a reciprocating engine exhausting into a low-pressure turbine. The overall efficiency of such an arrangement was, it was explained, greater than that obtained by any other method of compounding. The author then proceeded to describe the difficulties of utilizing to the fullest extent the energy of steam in certain classes of engines, which worked intermittently. A colliery winding engine was selected as a typical example.

A consideration of the working of a winding engine would, said the lecturer, reveal the difficulties of utilizing to the fullest extent the energy of the steam. The engine only used the steam during a part of each cycle, and in order rapidly to accelerate the tubs, it was usual to admit steam to the cylinders throughout the whole stroke for the first few revolutions. After this, the cut-off occurred earlier and earlier as the winding proceeded. Towards the completion of the wind, steam was completely cut off, and the engine gradually came to rest. An interval of several seconds then elapsed whilst the tubs were changed, and the cycle was then repeated. The effect of the intermittent workings was to cause a great variation to occur in the rate of steam consumption at any instant. In the example chosen, the rate of steam consumption fluctuated between the maximum and minimum values of 105,000 lb. per hour and zero. Were a condensing plant installed, it would be required to work under very disadvantageous conditions, and only inefficient results could be anticipated. The plant would, therefore, be disproportionately large for the normal requirements.

It was common, remarked the author, to find engines of this class exhausting vast quantities of steam uselessly into the atmosphere. The problem of utilizing this waste heat was solved in the year 1901 by Professor Rateau, of Paris, and at the present time, no less than 400,000 brake horse-power was being recovered from exhaust steam. The object of the system introduced by Professor Rateau was to obtain a regular supply of steam in place of the steam intermittently ejected from the primary engine. This aim was attained by passing the exhaust steam into a suitable heat accumulator, whence a continuous supply of steam was withdrawn to operate a low-pressure turbine. A description was then given of the various forms of heat accumulators employed for this purpose from the early forms to the most modern Rateau-Morrison type. The paper concluded with references to several existing installations.

D. M. MEDCALF.

CHIEF INSPECTOR OF BOILERS, ONTARIO PROVINCE.

D. M. MEDCALF, who has been inspector of boilers and machinery for the Province of Ontario public institutions during the past eight years, is now chief inspector of steam boilers for that territory, under the new Steam Boilers Act, with offices in the Parliament Buildings' new branch, Queen's Park, Toronto. The new Steam Boilers Act will come into force and take effect on and after July 1st, 1913. Under the new Act, Mr. Medcalf's duties will embrace a much wider range than heretofore, as all new boilers built in or entering the province will be subject to inspection by a qualified staff appointed by the Minister of Public Works, relative to their design, construction, etc., in conformity with the regulations.

Mr. Medcalf, in December, 1909, represented Ontario at a conference of Provincial Boiler Inspectors held in Regina, Sask. There, rules and regulations were drafted, and subsequently adopted by the Provinces of Alberta and Saskatchewan. Ontario has now adopted the like regulations, and it is fair to assume that the other provinces will approve and recognize these, with a view to securing uniformity throughout the entire Dominion ultimately.

Born in Toronto 40 years ago, and after serving his apprenticeship as a machinist with the Polson Iron Works, Toronto, Mr. Medcalf filled positions successively at the Lake Erie Engineering Works, Buffalo; the Baldwin Locomotive Works, Philadelphia; the C.P.R. shops, Winnipeg; the N.P. Railway shops, Brainerd, Minn.; the I.C.R.K. shops, Chicago, and with the John Inglis Co., Toronto.

C.A.S.E. 1914 CONVENTION.

A LARGELY attended meeting of the Ottawa branch of the Canadian Association of Stationary Engineers was held in the Union St. Joseph Hall, Dalhousie Street, early this month. Mr. Kastella, executive treasurer, presided, and gave an address on the duties of the engineer in the operation and economical management of small power plants. The local branch have been informed that the convention of the C.A.S.E. will probably be held in Ottawa in 1914.

The International Engineering Works, Ltd., Amherst, N.S., are building Robb water tube boilers for the Pictou County Electric Co., Stellarton, N.S.; the Ottawa Gas Co., Ottawa, Ont.; and the Inverness Railway and Coal Co., Inverness, N.S., while the Canadian Stewart Co., Montreal, have recently purchased 4 Robb-Brady Scotch boilers and one compressor.

The International Engineering Works, Ltd., Amherst, N.S., builders of Robb boilers and engines have recently sold horizontal return tubular boilers to the following companies:—The St. Lawrence Pulp and Lumber Co., Pabos Mills, P.Q.; the N. S. Clay Works, Halifax, N.S.; the Maritime Coal, Railway and Power Co., Joggins, N.S.; the Record Foundry and Machine Co., Moncton, N.B.; and the Rocky Mountain Cement Co., Blairmore, Alta.

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POWER PLANT EXPERTS.

IN a paper read recently before a prominent Engineering Society in England, entitled the "Layout, Design, and Equipment of Industrial Works, not the least outstanding feature among the many interesting points raised was that of the existence of the power plant engineer, and the necessity for his recognition in the matter of expert advice and service, in order that a plant suitable for a given manufactured product and to give the highest efficiency may be raised.

The author of the paper took occasion to pay manufacturers on this continent the compliment of having long ago recognized the place of and necessity for the industrial engineer, both when locating a completely new plant and when extending and adding to existing layouts. However, we are still open to secure pointers in respect of the employment of such specialists, and to progress still further towards perfection, even should they follow the results of comparisons drawn between factories on this continent and those in Great Britain. While generally speaking, we are well ahead in the matter of recognition of the place and part of the power plant engineer, there are instances, yes, of quite common occurrence, in which we find the manufacturer's staff performing, or at least attempting to perform the work.

As time goes on, however, and as training and experience become more developed in the profession of power engineering, there is bound to disappear all tendency on the part of responsible manufacturers to muddle along with a staff engaged for the production of some specialty, and who for the time being, turn power plant designers. The fact that the factory must be laid out and equipped to suit the product in its every phase, must not be lost sight of, and in most cases, be it noted here, there exists the constitutional difference between the work of the expert and that of the factory staff. The former as has been said operates with an eye to the products, all the time, while the latter, in the last analysis, generally have to trim the product to suit their handiwork.

Operating engineers, like other branches of the mechanical engineering and machine tool industries, have a live interest in the proper layout of their plant, and evidence is everywhere abundant of the remarkable development which has taken place during the last decade in this respect. To secure high degree quality of product by the most efficient means, methods and appliances in consonance with the comfort, contentment and co-operation of each and every individual operative, is a present-day achievement of many of our power houses, large and small, and it is not misplacing credit for such accomplishment when we say that the Plant Expert has contributed largely in bringing the existing satisfactory conditions to their present high standard.

Light (natural and artificial), heating and ventilation, convenience and distribution of power equipment and appliances in buildings whose location, design and constructional features have been the outcome of a well-defined scheme, are each and all attributable to the intelligence and influence of the Power Plant Expert.

ELECTRIC DRIVING OF ROLLING MILLS.

A NUMBER of reasons for British backwardness are given in a paper describing a new form of electrically-driven two-high continuous running reversing mill. The day has not yet arrived, however, according to the author, when it can be claimed that, by the universal adopton of electricity as the motive power for driving rolling mills in iron and steel works, the highest economy in running costs can be attained; and every proposed installation of such machinery should be most carefully considered in relation to the existing conditions and decided upon its true merits.

ELECTRICITY AND HYDRAULICS

This department is intended, in addition to individual treatment, to feature the close relationship existing between electricity and hydraulics in the power and light field.

ELECTRICAL EXHIBITION.

OWING to the numerous exhibitors who will leave Montreal to attend the Electrical Exhibition in New York, the dates for the First Annual Montreal Electrical Show have been changed. The exhibition was originally arranged to be held in the Arena from October 18th to 25th, but, now will be held in the same building from November 1st to 8th. Practically all the arrangements for the Electrical Show have now been completed, and the prospects are that it will be the most elaborate and most brilliant of its kind ever staged in Canada.

STANDARDIZATION OF ELECTRICAL MACHINERY.

WRITING in the columns of Vulcan on "The Standardization of Electrical Machinery," Mr. G. W. Worrall points out that when an individual drive of each machine in a shop is required it is sometimes necessary to instal some motors of a greater power than is actually required in order to keep the variety of motor sizes within the required limits. When, however, an individual drive is not necessary, the driven machines may frequently be so grouped as to take a given power. One of the best examples of an individual drive is a carpenter's shop, where each machine requires a motor of only a few horse-power. Some sacrifice must in such a case be made for the sake of standardization.

A case of such a shop came recently before the notice of the writer, when at a little extra cost, excellent standardization might have been effected, but where for the sake of cheapness motors had been installed of the exact power required. There were nine motors in all, two 20 horse-power at 900 revolutions, one 6½ horse-power at 875 revolutions, one 5 horse-power at 1,150 revolutions, three 3½ horse-power at 1,400 revolutions, one 2½ horse-power at 1,150 revolutions, and one 2 horse-power at 1,200 revolutions. The motors should have been divided into three groups; two 20 horse-power at 900 revolutions, two 6½ horse-power at 1,000 revolutions, and five 3½ horse-power at 1,200 revolutions. One spare armature for each group would have rendered the shop practically immune from any serious stoppage.

TIDAL WATERS AS A SOURCE OF POWER.

AT a meeting of the Society of Engineers, Incorporated, held on Monday, May 5th, a paper on "Tidal Waters as a Source of Power," was read by Mr. C. A. Battiscombe, the object of the paper being to draw attention generally to the commercial possibilities of hydro-electric installations, more particularly with regard to the use of the tides. After some introductory remarks in reference to tidal intervals and the range of neap tides, the author points out that in this connection the head of water available for actuating turbines cannot exceed one-third of the range of minimum tides. The form of installation required for a continuous output of power is then discussed, the chief objections to twin installations, so placed that the tidal interval at the one will not synchronise with the tidal interval at the other, being pointed out. An outline is given of the arrangements proposed for the constant maintenance of a working head, by means of a chamber for the turbines, connected by valves to the tidal way and to three reservoirs in which the tidal water may be impounded; and to this is added a description of the proposal of sequence of flow between the tidal way and the reservoirs.

It is claimed that the utilization of the tides for power purposes presents few engineering difficulties as far as principles are concerned, but that the real difficulty lies in the question of cost, and therefore in the choice of the site and in the design of the structural details.

The expenditure on commercial works that an engineer is justified in recommending is suggested, and some explanatory remarks are offered in respect to various items given in the rough estimate and to the principles governing the economical capacity of a proposed installation for any range of tide. The rough estimate follows next and the cost of the Board of Trade unit, obtained from the proposed installation, is considered from the point of view of supply and demand, both from a commercial and a municipal standpoint, on the basis of annual expenditure over a period of fifty years.

The paper concludes by insisting on the importance of regarding the supply of fuel as a matter that concerns the whole nation; that the demand for combustible fuel is continually increasing, and that coal being practically the principal fuel, it would be mere folly to neglect any other available source of energy whereby the present rate of consumption of coal may be sensibly reduced. It is submitted that not only can the tides be utilized as a constant source of power, but that, taken in conjunction with the power that could be derived from fresh water rivers, their utilization would be a great gain to the commercial and industrial interests.

REACTANCES.

IN the working of large power stations with very heavy outputs, the use of reactances for limiting the output of power on the occasion of an accidental short circuit has become an important question. Such coils are subjected to very uncertain forces; they must be without iron cores to avoid the effects due to saturation, they must be capable of withstanding severe mechanical stresses, and there are many other considerations to be taken into account owing to the uncertain nature of the work they have to perform. The coils built by one of the large electrical firms are wound on wood supports, which are bolted to a cylindrical concrete core, and usually consist of three layers. Bare copper cable is used, and the insulation depends on the spacing between the turns. With the normal current, there is usually a 6 per cent. drop between the terminals, although in certain cases this drop has been 2½ and in others 10 per cent.

Questions and Answers

Q.—What is the minimum monthly coal consumption that will warrant the installation of an ash conveyor in a boiler plant?

A.—Naturally the problem depends on the percentage of ash in the fuel and various local conditions, such as, construction of power-house, manner in which ash must be disposed of, etc. Speaking generally, where the furnace refuse is approximately 12½ per cent. of the coal fired, and with the usual arrangement of power-house, an ash conveyor may be found profitable when the monthly coal consumption exceeds 2,500 to 3,000 tons.

* * *

Q.—When coal is used in conjunction with shavings as boiler fuel, what is the equivalent valuation of shavings in terms of coal used?

A.—The relationship, as will be found, will depend upon the quality of the coal and the character of the wood from which the sawdust is obtained. If the plant is large enough to justify separate furnaces for burning coal and the available sawdust, this would prove the more economical method of operation, as the respective furnaces would, therefore, be adapted to each kind of fuel, instead of being made a compromise.

* * *

Q.—How does steam used for heating purposes in a system where the returns are fed direct to the boiler-feed water pumps compare with the normal system of a receiver or hot wells?

A.—If the entire exhaust is used for heating, then a receiver provides a manner of storing the condensation until it is required for feed-water purposes. Where only part of the exhaust is used for heating, the receiver is of little and of questionable value.

* * *

Q.—Where coal is regularly piled on the ground, and wheeled into the boiler room as needed, what is the usual loss?

A.—No special data are available on the subject of the loss due to piling coal on bare ground, but, judging from observation, little or no loss should occur due to this method of handling. There is a possibility of picking up some clay or sand with the coal at first, but as soon as a surface of coal dust and clay has been formed, there should be no further loss.

* * *

Q.—What weight of coal is required for banking fires over night, and for raising the steam to full working pressure in the morning? State individual instances and specific conditions, giving the rating and kind of boiler, length and width of grate of furnace, kind of coal burned, etc.

A.—The following data were obtained from boiler plant tests. For this reason, the coal burned is somewhat less than the average amount. "Run of mine coal" was used.

H.P. Boiler.	Type Boiler.	Banking Coal lbs.	Firing Up Coal lbs.
40	H.R.T.	17	...
40	H.R.T.	202	...
40	Marine	101	...
60	H.R.T.	131	...
70	H.R.T.	80	270
150	H.R.T.	0	800
200	Marine	0	785

* * *

Q.—Coke breeze for steaming purposes. Please state the kind of boilers under which it is burned, the proportion in which it is used with other fuel, the efficiency obtained and its effect upon the maintenance of the boilers and furnaces?

A.—Coke breeze made at the Gas Works mixed with slack coal in varying percentages from 5 to 50 per cent. has been burned under water-tube boilers with Murphy furnaces. No tests have been made as to efficiency. It works very well when used with slack coal in quantities of about 10 to 25 per cent. of the coke breeze.

* * *

Q.—(a)—What is the steam consumption of a duplex pump with steam cylinder 12 in. diameter, water plunger 8½ inches, stroke 10 inches, when pumping 500 g.p.m., against a head of 110 feet, static and friction? Steam pressure 100 pounds.

(b)—What is the steam consumption per hour, same steam pressure and water head, pumping 500 g.p.m., when using a duplex tandem compound pump, high pressure steam cylinder 8 inches diameter, low pressure steam cylinders 12 inch diameter, water plunger 8½ inches, stroke 10 inches?

A.—The data given is based on average practice as shown by tests on various makes of pumps. The dimensions given for these pumps are ordinary dimensions, and, therefore, would come under the range of ordinary practice.

As to the first question, (a), we figure the theoretical H.P. of water end.

$$\frac{500 \times 8.333 \times 110}{33{,}000} = 13.89$$

Assume the efficiency of water end approximately 80 per cent.

The delivered H.P. would be

$$\frac{13.89}{.80} = 17.36$$

The steam consumption at 100 single strokes per cylinder per minute may be assumed at 120 pounds per h.p., because of relatively high cylinder condensation when working under low head at rated speed. The steam consumption would be $120 \times 17.36 = 2083$ pounds per hour.

Referring to question (b), a compound pump of the size given would reduce the consumption about 20 per cent., which would make it about 1,666 pounds per hour, when working at a capacity of 500 gallons per minute.

* * *

Q.—In figuring the cost of water for the operation of isolated plants where the exhaust steam is used for heating during the winter months, and is expelled to the atmosphere during the remaining months, with engines running non-condensing, what percentage of the yearly amount of water, based upon the amount of coal used, is figured as being returned to the boilers?

A.—Without knowing the specific conditions of operation, the demand for steam heat, the amount of engine exhaust and the building and weather factors, it would be impossible to attempt to estimate how much of the boiler feed may be saved by returns from the heating system. The hourly and seasonal variations of the heating demand with respect to the power load should be correlated, and by allowing in the neighborhood of 75 per cent. condensation return of all steam delivered to the heating system (average installation), you may arrive at a fair percentage for guidance.

The foregoing have been selected from recent copies of the N.E.L. A. Bulletin.

CAUSES OF OVERHEATING IN STEAM BOILERS.

THE following article is selected from the "Memorandum on Steam Boilers" prepared some time ago by Mr. William Buchan, one of H.M. Inspectors of Factories, and will be found of considerable practical interest to all engaged in steam power plant work, irrespective of relation thereto:

Scale and Sediment.

Feed water often contains solid matter in solution or suspension. As evaporation proceeds, solid matter in solution is deposited as a fine precipitate which under certain conditions forms a hard scale or crust. Sea water acts in the same way, leaving a deposit of salt. If the feed water is sedimentary, i.e., contains solids in suspension, there will be a deposit of mud within the boiler. It is most important to prevent any accumulation, and the remedies may be classified as follows:—

(1)—Substitution of a pure water supply. (2)—Treatment at the boiler.

(3)—Removal of all scale-forming constituents from the feed water before it enters the boiler. The first remedy, although effectual, is not always practicable, and the second class covers such methods as (a) the systematic cleaning of the boiler and removal of scale; (b) blowing off regularly when the boiler is at work to carry away the deposit and keep the density below $\frac{2\frac{1}{2}}{32}$, and (c) the addition of a suitable solvent which prevents the deposit forming a hard incrustation. Before using any boiler composition, it is expedient to have the water analysed, and to settle the routine under expert advice, as a composition suitable with one kind of feed water may be useless with another, and it should be remembered that the use of such composition does not remove the necessity for systematic cleaning.

The most satisfactory way to deal with scale-forming constituents in feed water is to effect their removal before the water enters the boiler. Sediment may be removed by allowing the feed water to settle in ponds or by filtration, while hard waters may be treated by one of the many efficient water-softening plants in the market, and if temporary hardness only has to be dealt with, a considerable portion of the scale may be removed by using one or other of the satisfactory feed-water heaters now obtainable. The use of feed-water heaters and water-softening plants is gradually extending, as they effect considerable economy by increasing the efficiency of the boilers and reduce the work of scaling, and incidentally lessen the risk of explosion from overheating.

A definite interval cannot be fixed for cleaning and scaling boilers as so much depends on circumstances. For each boiler this interval should be fixed by experience, and the best guide is probably the thickness of deposit, which should not be allowed to exceed a sixteenth of an inch on the main heat-absorbing surfaces; particular attention should consequently be given to the removal of scale from parts exposed to high temperatures, for instance, furnace and firebox crowns and tubes of multitubular and water-tube boilers. These tubes can be kept clean by the use of brushes or tube scrapers of various types, and if the deposit is hard, turbine cleaners can be applied. The latter are operated by water, steam, or compressed air, supplied by a hose, and the rapid succession of blows by the vibrator or milled cutter knocks the scale from the tubes, leaving them practically clean. As nearly all the explosions of water-tube boilers occur at the tubes it is most important that they be kept clean.

Overheating Through Grease.

When exhaust steam is passed into the feed water to heat it, or the oily water of condensation from a condensing engine is used as feed water, grease will be present in the boiler, and as it becomes concentrated on the surface of the flues or tubes, will not only reduce the efficiency of the boiler, but be a positive source of danger, as it may lead to serious overheating and subsequent collapse of furnace crowns or tubes. A film of grease one-hundredth of an inch thick offers resistance to the passage of heat equal to a steel plate ten inches thick. In other words, grease offers a thousand times the resistance of steel to the passage of heat.

If it were only realized that the apparently harmless film of oil offered as much resistance to the passage of heat as a thick deposit of hard scale, more care would be taken to eliminate it. When oil is present in the feed water, much of it exists in an emulsified condition, i.e., in the form of minute suspended globules. The principal methods now in use for the removal of grease are:

Filtration of feed water. Whether gravitation or pressure filters are used, the feed water passes through some filtering medium, such as canvas or sand. In land boilers this system is not advisable, as a rule, except as an auxiliary to other methods, as the filters only remove the bulk of the oil, but not the finest particles of it.

Separation of grease from the exhaust steam before the steam enters the condenser or heater. A grease separator consists of a metal chamber with a number of baffle plates inside. Owing to the large volume of the separator, and the presence of the baffle plates, the velocity of the exhaust steam is reduced and consequently the bulk of the oil is thrown down. This method gives better results with non-condensing engines than with condensing engines, results being often unsatisfactory with the latter, because of the great velocity of the steam as it passes through the separator.

Chemical treatment of the greasy water and subsequent filtration.—The feed water is automatically treated with correct proportions of suitable reagents which collect the minute globules in a form suitable for removal by filters of wood fibre or sand.

Electrical treatment of the greasy water and subsequent filtration.—The water is allowed to collect in a vat; the passage of an electrical current through the water, by means of metal plates, causes the minute globules to coalesce, and in this form the oil can be efficiently removed by sand filters.

If it is desired to heat the feed water by exhaust steam from which the grease has not been removed, the steam should be conveyed in coils of pipes, and should not, upon any account, be brought into direct contact with the feed water. Where condensers are used, very satisfactory results can be obtained by combining a grease separator (placed between the engine and the condenser), with a good chemical or electrical method and subsequent filtration.

REFRIGERATING MACHINERY.

The Editor, Power House:—

We notice in your May publication in which you give a description of the plant of Gunn's, Limited, West Toronto, that you give therein our former name, namely, "The Linde British Refrigeration Company, Limited," as the manufacturers of the refrigerating machinery. On account of the change in our name and as an English firm has the same name as our former name, your statement might be misconstrued, as if such machinery had been supplied and installed by them (the English firm), and we therefore would be obliged to you if you would rectify this in your next publication. We may say that the change in our name has not made any change in the personnel of our company, and our machinery and material is the same as has been manufactured by us in Canada since 1895, and with which we have built up our high reputation as to efficiency and workmanship. As stated above, we would be obliged if you would rectify this matter in your next publication, so that your readers will realize that the machinery in Gunn's, Limited, West Toronto, is of Canadian manufacture and installed by us.

Thanking you in anticipation, we are,

Yours very truly,

The Linde Canadian Refrigeration Co., Limited.

C. W. Vollmann, President.

POWER FROM WASTE PRODUCTS.

By A. Home Morton.

CERTAIN manufacturing processes have features which bear direct upon the question of power generation and transmission. Iron and steel works have so-called "waste gas" and "waste heat" from which power may be obtained; collieries large quantities of low grade fuel and filtered washery liquor or coke oven gas; saw-mills, carriage and wagon works, a certain quantity of timber refuse; exhaust steam from smithy hammers; while in other classes of factories, bleach and dye works, chemical works, sugar works, etc., the demand for steam for the manufacturing process may exceed the demand for

steam for power. A decision, therefore, on this question of power generation and transmission demands the consideration of all the several forms of generator and motor before any conclusion can be come to, as well as of all the features and possibilities of the works themselves, and further, this consideration of the question must be impartial.

To compare an antiquated steam-driven shafting system, which has just been superseded, with a high-class gas-driven system, which has just been installed, is only of value in that it indicates the saving effected by the introduction of modern power plant. A few years ago there was a boom in gas engine plants, and gas engines were placed in scores of works after only the minimum of considera'ion of the works' requirements. To-day, the traveler for gas engines has given place to the traveler for electric motors, and there is a boom in the installation of electric motors, in many cases with as little consideration as in the case of the gas engine.

The author ventures to say that nothing could be more prejudicial to the best interests of the electrical industry, an industry in which all are intensely interested, than the thoughtless manner in which electricity is often adopted for industries where even brief impartial consideration would raise doubt as to its entire suitability. Partisan figures and statements are presented to probable purchasers, and they are thereby led to adopt plants through having been unable to discriminate between what was reliable and what was misleading.

Each System Has Its Advantages.

The following general statements may not be new, but they form an essential part of the subject and cannot be ignored. Like all generalisations, they are subject to modification under particular circumstances.

The first conclusion, and that to which it is difficult to reconcile the partisan mind, is that each system of power generation and transmission has its particular advantages and superior economy, and that maximum economy in works driving in a particular case may be obtained by a combination of two or more systems. The difficulty is usually not so much the selection of the system as the determination of the extent to which it should be utilized.

Dealing first with transmission systems. Where the plant is compact and conveniently arranged within a radius of, say, 100 or 150 ft. from the central power plant, mechanical transmission is most economical, while, with an increased radius, gas or electrical transmission has advantages, the former being the most enticing system from the point of view of thermal efficiency, but meantime having a more limited application. From this it follows that, in small works and factories, the most careful thought ought to be given to the works design in order to ensure a compact arrangement and efficient mechanical transmission.

Where tools are set widely apart, electrical transmission with independent motors is economical, although where it is possible to have a group of tools in a works, an independent gas engine or electric motor driving these through gearing is more economical than independent motors.

Where the amount of power required for individual machines is small, it is almost always advisable to group them. That this conclusion is borne out in practice will be seen by examining the published descriptions of the electrification of several large engineering and shipbuilding establishments. From these descriptions it will be found that the average size of motor is steadily rising.

The question of reliability and consequent need for stand-by plant is also important. Practically any one of the systems, if properly installed, can be regarded as reliable, but the sub-division secured by the use of motors or small gas engines has advantages.

The chief advantages of the electrical transmission system are its adaptability and the ease with which it can be extended, and its chief drawback is its cost, a part of which, at least, is due to the refinements which have been introduced into electrical controlling and operating mechanism.

Merits of Electrical Transmission Systems.

Before passing from the question of the transmission system, a word or two might be interesting upon the merits of the rival electrical transmission systems. It is probably largely a matter of opinion whether a direct current or a three-phase alternating current transmission system is more desirable.

The question of power generation, like the question of transmission, depends for its solution upon the conditions of service. Where the power demand is very intermittent, purchased electrical energy has advantages over all other systems, although for dock pumping, slipway haulage, and other heavy intermittent loads, gas engines, using town's gas, are very economical in use. For a moderately steady demand up to about 100 to 150 b.h.p., the suction gas engine has no rival. Above this load it is possible to purchase steam plants using highly superheated steam, which can generate one i.h.p. per hour, at a fuel cost of little over 1 lb., and a steam cost of approximately 8½ lbs. Such a plant is, however, uncommon, and until it becomes more general, the range of usefulness of the suction gas engine may be said to be 150 to 200 b.h.p. Above this limit a steam plant using low grade fuel has advantages which have been greatly enhanced by the recent advance in the price of anthracite. Indeed, the position of the steam engine or turbine of single unit plants of over 200 b.h.p. is not even to-day seriously assailed, except where the main question is complicated by side issues, or where the cost of coal is well above the average, the advent of the geared turbine being a most interesting and pregnant development.

Where an electrical transmission system has been decided upon, the purchase of current demands first and most careful consideration. If a private plant is decided upon, then the generators may be either steam or gas engine driven. The units, in the case of gas engine driven generators, may be of practically any size desired, while steam engine driven units may be reciprocating engines up to 750 kilowatts, and steam turbines thereafter. Interesting results can be got from the combination of reciprocating engines with steam turbines, a combination of this character giving a wide range of economical load at a modest capital cost, this advantage being obtained by cutting out the turbine from the lower loads and exhausting direct from the reciprocating sets to the condensers.

The sphere of usefulness of the large power gas engine is confined mainly to situations where so-called waste gas can be obtained, as at coke ovens and blast furnaces, or where chemical plant already is installed. Ironmasters are unfortunately even now by no means unanimous in their desires for these generators. There cannot be any doubt, however, that where waste gas is available, the large power gas engine is in many ways desirable.

The side issues in works power plant also require consideration. The utilization of exhaust steam in turbines, from blast furnaces, and coke oven gas in large power gas engines, and the development of the storage battery in connection with the fluctuating loads in large works, are all problems of remarkable interest, but time does not permit of anything like consideration of these, nor does the title of this paper seek to cover them.

The Tilsonburg Electric Car Co., Ltd., incorporated at Toronto, to manufacture steel cars, etc., at Tilsonburg, Ont., with capital of $40,000. Incorporators, Thomas J. Baillie, Albert E. Medhurst, James Chandler, William Russ.

THE OPERATORS' VIEWPOINT

Devoted to brief descriptive article contributions covering ideas and experiences pertaining to power plant practice and operation. We pay for accepted material.

ECONOMY HINTS FOR POWER USERS.

By F. R. Parsons.

THERE are many economies permissible in the power house which, insignificant individually, are worth considerable attention in the aggregate.

A pulley with a face burnished smooth as glass and polished like silver denotes slip. The discrepancy in the speed may not be proclaimed by a creaking belt, but it is there; a continual waste. The pulley may be undersized for the work or the belt slack or too frail, or its face glazed and dry, or a bad type of fastener is in use—any one of which may cause the trouble.

Inconvenience may be caused by the heating of a line-shaft bearing, which has cut badly, necessitating the removal of the top cap to re-channel the oil ways, and perhaps letting the top brass down a trifle to compensate for bottom wear. If so, the shafting may have dropped a little at this point and need aligning and a little packing. Neglect of this creates a point of unnecessary friction and is a source of direct loss.

Packing Gland Leaks.

One of the most fruitful sources of waste, where steam is the motive power, is at packed glands. When compelled by very shame to do something to subside the hissing, the attendant may screw up the gland as tight as it will go. If that affords but temporary relief he removes perhaps the first ring. or two of packing and replaces with new. The old at the back of the box is too troublesome to remove, so it remains there, providing unnecessary friction and hastening the day, when a new rod will be required. The engine room attendant should be afforded a practical demonstration of how to pack a gland, the principles involved, and the advantages of using the kinds of packing best suited to the various requirements.

Generally a packing box is filled with ordinary fibrous packing, with or without a cushion core, and the gland nuts set up to ensure a steam-tight joint. As there can be no possible running adjustment with such a packing, sufficient pressure must be exerted on it and against the rod the whole of the time, to prevent leakage against the maximum pressure. As this maximum is only exerted momentarily during a fraction of the stroke, it follows that the pressure on the rod during the remainder of the stroke is excessive, and unnecessary power is expended by the engine in overcoming friction which should not exist. This represents wasted coal, reduces the life of the packing and unduly wears the rod, and can be avoided by selecting a packing which will automatically adjust itself to the varying conditions.

A perfect packing will only exert the pressure limit on the rod when needed at the moment the maximum pressure is upon it, as in the case of an engine at the point when the stroke commences. Directly the point of cut-off is reached, the pressure on the cylinder drops, and the pressure on the rod due to the packing should decrease in a like ratio. The packing most likely to fulfil these requirements in practice automatically expands and tightens itself against the rod under the varying pressures in the cylinder. Its steam-tight properties in the stuffing box are not, as in the fibrous type, governed by the pressure put on by the gland nuts, but is controlled by the direct action of the pressure in the cylinder acting on the automatically adjusting sections.

A series of tests taken on a 100 h.p. engine running at 235 r.p.m., with a piston speed of 783 feet per minute, in order to determine the relative values of packings, proved that it took 33 1-3 per cent. more power to drive the engine with ordinary fibrous packing which had become hard and charred, and required considerably more pressure on the gland nuts to keep the joint steam-tight, than to drive the engine at the same speed with the glands filled with packing of an improved type with the gland nuts but very slightly over finger-tight.

Oil and Lubricants.

Amongst other economies is that of oil and other lubricants. Over anxiety to keep a troublesome bearing cool often results in going to the other extreme, viz., flooding. It is an old saying and true that a spoonful of oil at the right moment saves a gallon at the wrong. And this, if divided into drops, is worth far more than the whole dose given at once.

Then, what is done with waste oil? Does it run through the bearings and on to the floor? Oil, unless burnt, has lost none of its lubricating qualities in passing through a bearing. Oil filters are cheap, convenient, automatic in use, and will save their initial cost in a few months. The dirtiest of oil will come through them clear and fresh as when first drawn from the cask, and with none of its lubricating qualities impaired. On installing one of these, have all your bearings provided with suitable drip tins to catch the superfluous oil; also make provision on your engines for draining away all that has dripped from beds and splasher plates. Thick and black oil will clarify in the filter, but first let it settle in a vessel for a few days before putting into the filter, so that as much of the impurities as possible may fall to the bottom.

Economy in Belting.

Economy in belting is practiced by preserving as far as possible the natural state of the leather. When new it is pliable because of the natural oils contained therein; but when these become absorbed through atmospheric conditions or prolonged working, the material becomes brittle, surface cracks develop and the end of the belt is in sight; especially in belts working under abnormal conditions, such as over boilers, exposed to weather, chemical or acid fumes, or when anything of an abrasive nature is always present in the air. Under any conditions, belting requires a periodical dressing of a nourishing nature. If leather, a good dressing of equal parts of neats-foot and cod oil, mixed and applied with a stiff brush, is as good as anything; if cotton or canvas, crude castor oil will keep a belt in good working order and reduce to a minimum all tendency to slip.

There is a double economy effected in taking care of belts, as they not only wear better and longer, but a well-pre-

served, pliable belt will transmit more power than a dry, neglected one.

The Boiler Room.

I have indicated a few points as they occurred to me; but there are others—perhaps scores—which will catch an observant eye, yet some men will never notice the boiler attendant sweeping away coal with the clinkers, firing the boiler or adjusting the feed water irregularly, or not appreciating to the full the proper use of the dampers, with the result that a dozen times a day golden dollars are being blown through the safety valve. If the armature brushes on the dynamo are sparking, there is another source of waste: not only the brushes are burning down and will soon require renewing, but the commutator is being unduly worn.

The eye of a trained man notices these things and he demands an alteration. Attention to these details means, in the aggregate, a lot to a power user when his profit and loss account is made up at the end of the year.—Machine Tool Engineer.

WHAT SHOULD A FIRST-CLASS OPERATOR KNOW?

By Mechanic.

UNDER the above caption in the April issue of The Power House "J. T. A." makes some remarks that lead one to infer that it is a big mistake to have a first-class examination any harder than an ordinary engineer can negotiate. This is an entirely wrong view to take of the matter. The idea of a first-class grade is, or should be, a means of choosing what the name implies—a set of strictly first-class engineers, and right here, let me say, that an engineer who has to get a machinist to caliper his engine cylinder for wear is not a first-class man; nor is he of the first grade, if he cannot estimate from the machinist's figures (for instance) whether or not it will be safe to have the cylinder bored out a second time, considering the boiler pressure carried. The same would apply to turning up a badly worn piston rod, as well as a dozen other shop repairs that crop up from time to time in power plant operation, and this without touching the boiler end of the proposition at all. The above few examples should serve to show that a practical knowledge of machine shop work is not too much to expect of a first-class engineer.

The Draughting Feature.

Now for his knowledge of draughting. If he requires a certain piece of power plant apparatus made or repaired, such as some part of his engine, condenser, pump, etc., he would hardly be termed a first-class man if he could not send along with his order an intelligent sketch or shop drawing showing all necessary dimensions and views. A proper sketch or drawing requires no verbal explanation, and certainly is no more than what a manufacturing or repair shop superintendent would expect to receive from a first-class engineer, unless the work required was according to some standard.

As regards the designing end of the work, it is a fact well known to any engineer of long experience that certain parts of power plant machinery often come from the manufacturer wrongly designed, and give no satisfaction until a design is worked out that will eliminate the trouble. A case in point throws a little light on the reverse side of the statement, by "J. T. A.," that "It is said that shop and draughting-room experience enables a man to see into things, yet these same kind of men have been stuck on simple power plant problems that any third-class practical engineer could handle."

A certain second-class engineer employed in a plant where a machinist was kept for repair work started to remove a common throttle governor as the flange joint was leaking. The machinist, working near, remarked to him to look out for the throttle-valve-stem when he lifted the governor off, but the engineer knew all about it. He did not lift the upper portion off straight, with the result that the slender stem was bent badly, and a new one had to be made to take its place.

Engineer v. Machinist.

In comparing the ability of a machinist and an engineer, "J. T. A." should consider an average man in each case. It is hardly fair to put up a dub machinist against an average smart engineer, and certainly I do not believe that the average machinist will get stuck on problems that any third-class engineer can handle. The trouble with a lot of engineers that kick about a first-class examination being too severe is that they wish to be rated as first-class men in the craft, but are too lazy to get down to brass tacks and study the design, capacity, etc., of the various machinery under their care. Sometimes it is a case of not wanting to put in the required number of years—they want to be a first-class "chief" all at once.

The examinations of Alberta and British Columbia are rated, I believe, as the hardest in the Dominion to pass, and yet you don't hear any awful roar going up in either of these provinces about the qualifications being impossible. If a man cannot be a first-class engineer, he can be a good second, and in this respect there is no hardship involved. There can be no doubt that the chief engineer of a plant should be a first-class man, for it is upon him that the whole responsibility of upkeep, safety, etc., rests. It does not follow, however, that all his operating engineers should have first-class certificates also.

The following qualifications for first-class examinations in the two Western Provinces should be carefully considered by the Ontario engineers and licence board before adopting or recommending anything easier:—

British Columbia Requirements.

"A candidate for a first-class certificate must be not less than 22 years of age; he must have served five years as engineer in charge of a watch of a steam plant of not less than 300 horse-power; or he must have served four years in a workshop on the making and repairing of engines, boilers, etc., and one year as engineer in charge of a watch of a steam plant of not less than 300 horse-power. He must also have been in possession of a second-class certificate for six months."

Alberta Requirements.

"Candidates (for first) must furnish proof of at least 24 months' experience in a shop, repairing or building boilers and engines, and one year's experience in charge of and operating boilers of 300 h.p. or over."

ELECTRIC MOTORS AND MICE.

THE insignificant mouse has, since the advent of electricity, played some rather curious pranks with electrical apparatus by his innocence of volts and amperes, and many a disastrous breakdown must, we fear, be put down to his inquisitiveness to explore the inner resources of electrical apparatus in his nocturnal rambles. It is not always possible to secure evidence of the part he has played in these matters, though he does occasionally pay for his temerity with his life and leave his electrocuted body as testimony to the role he has played. Motors in food purveying establishments are especially prone to receive his attentions, as we are reminded by a recent report of a Vulcan Co. surveyor respecting a visit to a motor of this kind in a butcher's shop. He remarks "it would be advisable to leave the cover off the motor, at least during the night, as, on examination, I found quite a lot of small pieces of meat inside the case which have been carried in by mice; the motor being covered in evidently made a good place for them to hide in."

PROGRESS IN NEW EQUIPMENT

There is here provided in compact form a monthly compendium of the power plant manufacturers' achievements.

THE NATIONAL OIL SEPARATOR.

AS long as the steam engine remains a prime mover, there will be oil in the exhaust as it comes from the cylinder. To get rid of this oil before the exhaust steam is used in heating and drying systems, or condensed and put into boiler, is advisable, and in the minds of most engineers, necessary. Oil, a non-conductor of heat, causes the boiler plates to become overheated resulting in bulges, blisters, and, finally in leaks, if not explosion. Foaming is

THE NATIONAL OIL SEPARATOR.

also caused by oil. As the condensed steam is returned to the boiler in the form of water, various forms of filters and skimmers have been used in the attempt to separate the oil after the exhaust steam has been condensed. While these devices have proven fairly satisfactory it seems better practice to remove the oil from the steam before it is condensed.

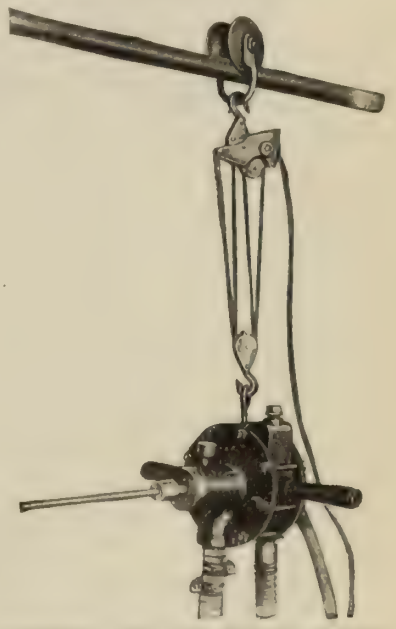
In the National Oil Separator, gravity, impact, and change of direction serve to take the oil from the particles of steam, and properly arranged baffles prevent it being picked up again and carried along in the current of steam. The steam entering, first strikes the main baffle which extends the full width of the separator. In this baffle, is a series of ports so located that the steam must make a right-angle change in direction to approach them. Each port is protected by an individual baffle which consists of a tube cast on the main baffle at the port opening. The tube extends to the front wall of the separator. The individual baffle forms a wall of metal opposed to the approaching current of steam, and causes a further change in direction and absolutely prevents any oil being carried into the larger chamber beyond the main baffle plate. This arrangement of plates with the individual baffles is a feature of the National Oil Separator. There can be no friction or drop in pressure for the area of the ports through the baffle plate is 1½ times greater than that of the inlet pipe.

The National Oil Separator, made by the National Pipe Bending Co., New Haven, Conn., is cast in two parts to allow inspection and test of the baffle plate, so that the casting will be free from defects or porous spots. The joint where these two parts come together is machined and guaranteed permanently tight, and at the bottom of the separator, a large drip leads from the storage chamber, and is used for draining the separator to the sewer.

These separators are made in a full line of sizes for pipes from 3 inches to 24 inches, and are furnished with water gauge and drip valve. The flanges are faced and drilled to A.S.M.E. standards.

NOVEL BOILER CLEANING ARRANGEMENT.

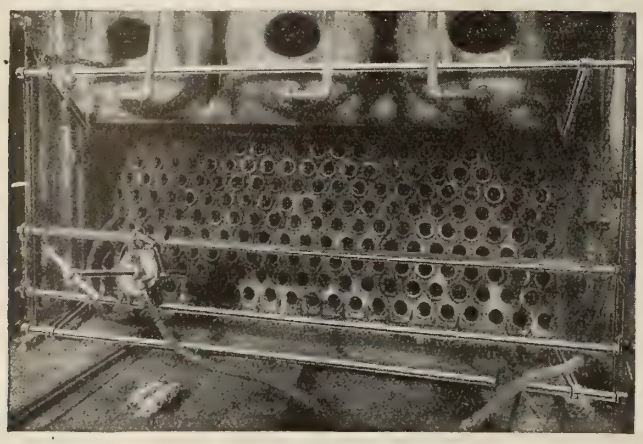
NOT all engineers appreciate the fact that the money returns that an expensive piece of machinery, such as a boiler will give, depend upon keeping it in service the maximum amount of time, and that it frequently pays to install protective or supplementary apparatus, so that the more expensive piece of machinery may work at a maximum load factor. For instance, in the power plant of the Colorado Springs and Interurban Railway Co., Colorado Springs, Colo., the feed water is exceptionally bad, and a very hard scale rapidly accumulates in the boilers. It was impossible to remove this scale economically with any ordinary turbine or self contained air driven cleaner, therefore, in order to expedite boiler cleaning operations, and to greatly decrease the time that a given boiler is kept out of commission for cleaning purposes, this company found it advisable to provide the special boiler cleaning attachment shown.



LAGONDA AIR OR STEAM MOTOR.

A Weinland mechanical cutter head is used for removing the scale, and this is driven by a Lagonda external steam motor. The motor is so designed that the square shaft carrying the cutter head can pass directly through the motor, and while revolving at high speed, can be worked back and forth in the boiler tubes, the motor remaining stationary upon the supporting frame. This motor is supported between rollers at top and bottom and is given a horizontal motion on the two supporting bars by means of the small handle shown at the top of the motor, which turns a pinion operating on a rack on the top supporting bar. To shift the motor vertically, the two horizontal bars sup-

porting the motor are elevated by means of pinions operating on vertical racks, these pinions being operated by a crank handle being attached to the shaft by a horizontal and vertical pinions are held in place by pawls, so that after the motor has been adjusted in front of a tube, it remains stationary until all the scale has been removed from that tube. The motor can be driven by either air, steam or water pressure, and with steam at 100lb. pressure, it will develop 7 horse power, enough to remove the hardest possible scale. The shaft supporting the cutter head is sectional and additional lengths are added as the cleaner is worked into the tubes, the handle being attached to the shaft by a swivel joint. While an equipment such as this would not be recommended under all circumstances, it has in this case, paid for itself many times over.



SPECIAL ARRANGEMENT FOR SUPPORTING THE LAGONDA MOTOR DRIVEN CLEANER.

The entire apparatus was designed and installed by one of the engineers of the Lagonda Mfg. Co., and has proved so satisfactory where the scale conditions are exceptional, that several other similar equipments are now being installed.

ECONOMIC CONDITIONS FOR LIQUID FUEL.

CONCERNING economic conditions of using liquid fuel, many of these are worn almost threadbare, but it may be well to enumerate a few, because coal under any condition is admitted to be a dirty, wasteful and variable means of raising steam and providing power, and, therefore, although the oil costs more initially, there are many compensations to be gained by its use.

Primarily, coal is costly to handle compared with oil fuel. The consumption of oil is perfect, provided due care in the design of the apparatus is taken. There is neither smoke nor smell; no ashes; no waste in starting up or shutting down; its calorific value may be taken as 50 per cent. better than coal; perfect and instant control of the fires may be obtained; they can be started off or shut down at a moment's notice, and, unlike all coal fires, no fuel is expended and no heat is lost when the oil fuel supply has stopped.

All boilers, of whatever type, are available for the use of liquid fuel without any modification of the arrangement of the furnace as used for coal, except in some special cases. In the case of industrial process furnaces, oil fuel will sometimes do three times the work of coal. Much depends upon the design of the furnace, and too much attention cannot be given to this important matter.

The various improvements which have been effected in the fire brigades of some of the leading cities are owing to the adoption of liquid fuel. So infinite are the uses to which liquid fuel can be put, and, in many instances, the economies which can be effected are so striking, when every aspect of the question is studied, that the relative value of oil fuel versus coal cannot be decided hastily by a mere comparison of the relative cost of the two fuels. The relative cost of the fuel alone is the chief consideration of most business men, who overlook the important factor of cheaper production, and more of it and time saved.

WELDING—ELECTRIC AND OXY-ACETYLENE.

THE Marine Department of the Board of Trade has now, after trial, approved the electric and oxy-acetylene processes for repairs to boilers of passenger steamships. The recent instructions to surveyors state that, provided the work is carried out to their satisfaction by experienced workmen, these processes may be employed, within limits, for repairing cracks in furnaces, combustion chambers and head plates, and in the same parts for reinforcing the landing edges of leaky riveted seams which have become reduced by repeated chipping and caulking. Repairs to any parts of boilers which are wholly in tension under working conditions, such as cylindrical shell plates and stays, are not, however, allowed by these processes.

In some old furnaces repaired by the above processes, it has been found that, after a few months' working, cracks again developed at parts near to those welded, probably owing to the material of the furnace having become fatigued and worn by long and severe usage. When dealing with old furnaces, this fact should be considered. In proposed repairs of an uncommon or unusually extensive character, the particulars should be submitted for the Board's approval.

After repairs by welding have been completed, the parts at or near the welds should be hammer-tested, and a hydraulic test of not less than one and a half times the working pressure should, as a rule, be applied to the boiler after the hammer-testing.

LARGE STEAM PLANT.

CONTRACTS for a steam plant of 60,000 k.w. capacity have been placed recently in New York by Messrs. Guggenheimer & Co., New York, for the Chile Exploration Company. The equipment at present comprises four 10,000 k.w. Siemens generators, coupled direct to four 14,300 s.h.p. Zoelly steam turbines of Escher Wyss & Co., Zurich manufacture. These units will run at 1,500 r.p.m. when working with steam of 170 lbs. pressure and 325 degs. centigrade superheat. Escher Wyss & Co., Montreal, who are attending to the American business of their Zurich works, have secured this order against competition from the foremost American and European makers on the strength of the low steam consumption of their turbine.

The plant is to be installed in Chile, and the power used for electric smelting of copper ore. The transmission line, which is 200 miles in length, will be for 110,000 volts pressure. Siemens-Schuckert Werke have been awarded the contract for the whole of the electrical equipment.

Aurora, Ont.—The Positive Clutch & Pulley Works has shipped to Bobcaygeon for the hydro-electric system a pulley 135 inches in diameter, with a 20-inch face.

Sectional Water Tube Boiler With Positive Circulation

The accompanying illustrated descriptive article deals with a new product of the old established, yet up-to-date and enterprising firm of Canadian manufacturers—The Goldie & McCulloch Co., Ltd., Galt, Ont., and the data furnished sets forth, we believe, this new unit of power plant equipment in an attractive and instructive light.

HITHERTO, all water tube boilers manufactured in Canada have been of the wrought steel header or water leg pattern, consisting of tube and handhole sheets, flanged, riveted and stayed together; the neck being shaped to fit the drum to which it is riveted. A large number of this class have been built by various firms, although differing in details according to the ideas of each designer, and, with a few exceptions, most of them have given good service.

Sectional Type Advantages.

The pattern, however, most generally favored and called for in the specifications of engineers, architects and other, is the sectional type, on account of its simplicity of design, absence of stayed surfaces, ease of transportation and general adaptability where other types cannot be used. It has, however, been long recognized by those conversant with this type of boiler, and in charge of plants where it is in daily operation, that there was room for improvement, particularly as regards the mode of circulation, and that by a modification in design, a much more efficient steam generator might be produced, which would not only increase its evaporative capacity, but at the same time eliminate the trouble experienced in connection with the lower rows of generating tubes.

Another, and very important point to be noted in connection with a boiler of this description, is that the use of cast metal is absolutely prohibited, a feature which has hitherto limited the extent of its manufacture, and in the boiler we are about to describe, it will be found that the headers, their fittings and cross-box are made throughout of forged steel, a new and specially designed plant having been laid down for the purpose by engineers experienced in this class of work. In this respect, the firm, we believe, takes the lead amongst the boilermakers of Canada.

Before proceeding to describe and illustrate the boiler, we might add that the pattern is by no means experimental, large numbers being at work in France, Belgium and other European countries, differing mainly in details, the chief and most important of which is the form of header, this being in a number of cases made "straight," thereby rendering the boiler less efficient than with the staggered form, whilst the drums and other parts of the circulating system, being more restricted in area, tend to reduce their generative capacity more than with the pattern we are about to describe.

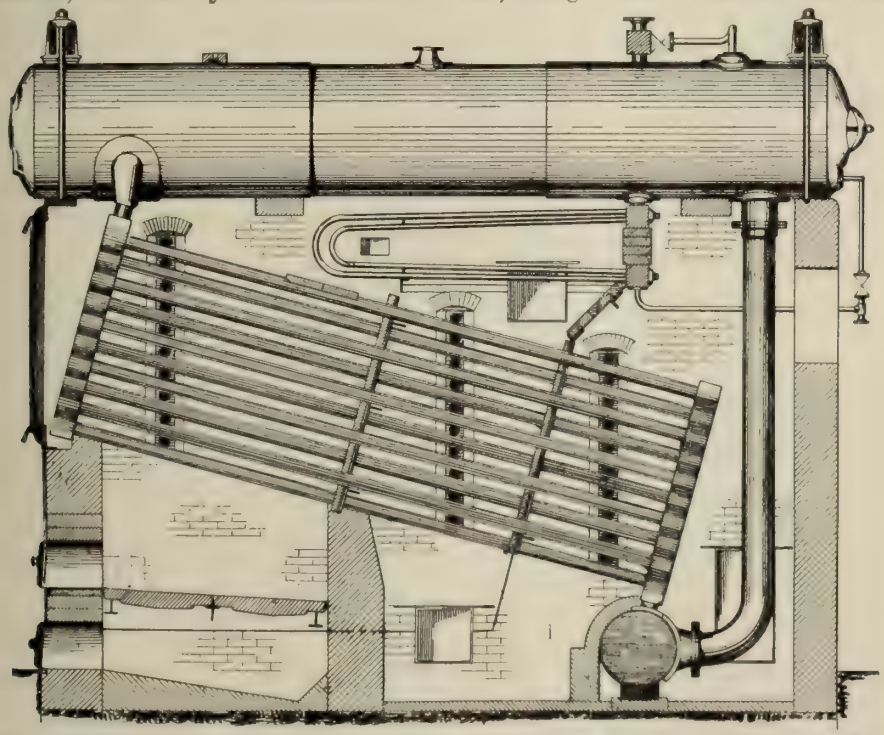


FIG. 1. GOLDIE & McCULLOCH STANDARD SECTIONAL WATER TUBE BOILER.

Standard Type Boiler.

The boiler as shown by Fig. 1, is somewhat similar to many others of this class, differing chiefly in several essential points, in that it embodies distnct features designed to improve the circulation and steaming capacity, minimize the cost of repairs and maintenance, and, by directing a full supply of water to the point where most needed, keeps the generating tubes well supplied under all conditions. The boiler can, therefore, be forced to a large degree, without endangering in any way the safety of its constituent parts.

It is constructed entirely of best quality mild steel, and consists of a number of lap welded and seamless steel tubes varying according to the size and capacity of the boiler, arranged in sections, and connected at each end to a sinuous header in the manner so well-known with this class of boiler. The headers Fig. 2 are of forged steel, of extra large enternal area, and staggered so that the tubes of one row lie immediately over the space between the two tubes immediately beneath it. Into these headers, and on one side of them, the tubes are expanded, there being an opening on the other side opposite the end of each tube for cleaning and inspection purposes, the opening being oval in form and closed with a handhole plate "placed on the interior of the header and held in place by a forged steel bridging bar and bolt; the joint being made with, and not against the pressure, only a copper or asbestos joint ring is necessary.

The steam and water drums are made of large diameter, so as to provide liberal disengaging surface and increased storage capacity for the steam. At the front of each drum, and riveted to same, is a forged steel cross box made from the solid plate; this is connected to the front headers by nipples of extra large diameter, so as to facilitate the flow of steam and water from the headers to the drum, the enlarged size of header alone permitting of this arrangement. The larger nipples, with the easy curves of the header, promote, it is claimed, a more rapid and efficient circulation than in other boilers of its class.

At the rear of each drum, and connected to a wrought steel nozzle, is a large circular downtake pipe of lap-welded steel, which conveys the water of circulation direct to the bottom of the headers, both being connected to a cross drum of large capacity. By this means, a full and constant supply of water is delivered to the lower rows of generating tubes immediately over the

furnace, eliminating the troubles usually experienced due to over-heating, buckling and burning out of tubes. The cross drum as will be seen in the illustration is fixed at the lowest part of the boiler and in a position remote from the action of the fire. It is also so arranged as to receive all impurities deposited, the capacity per unit of length being twelve times that of the small square section tube generally used. The drum made of best quality steel plate, is fitted at one end with a manhole, and has also a solid weldless steel nozzle riveted for connection to each downtake pipe.

It will thus be seen that the circulation in this boiler is "positive," the water flowing continously in one direction, every tube being brought into action instead of the circulation being short circuited in some tubes, and sluggish and even reversed in others, a fact not only known to users of the ordinary sectional boiler, but also emphasized in the "Stirling Book on Steam." In this new sectional boiler, however, there is little disposition to these conditions, the lower rows of tubes in which the greater part of the steam is generated, being fully supplied, and under the effects of rapid circulation are free from the danger of scaling which with an inadequate supply of water soon involves destruction of the tubes.

Another important improvement is in the spacing of the tube centres both horizontally and vertically, being greater than in other boilers of this class, while adding materially to the efficiency of the boiler and permitting of better mixing and combustion of the gases. Where boilers are fired with blast furnace gases, this arrangement of tubes will be found to be decidedly advantageous, on account of the varying condition due to atmospheric and other changes in the process of smelting. It will also be found that the grate area per unit of length is greater than in any similar boiler, a point to be carefully noted when dealing with different grades of fuel. By the elimination of the small downtakes usually found at the rear of this class of boiler, the gases have less retardation in their passage to the damper, and consequently a better draught is obtained throughout. The boiler is hung from a massive framing of rolled steel beams and channels, and is so designed as to permit of free expansion and contraction without any undue strain. The fittings and fixtures are all of the best design and manufacture in accordance with the latest practice.

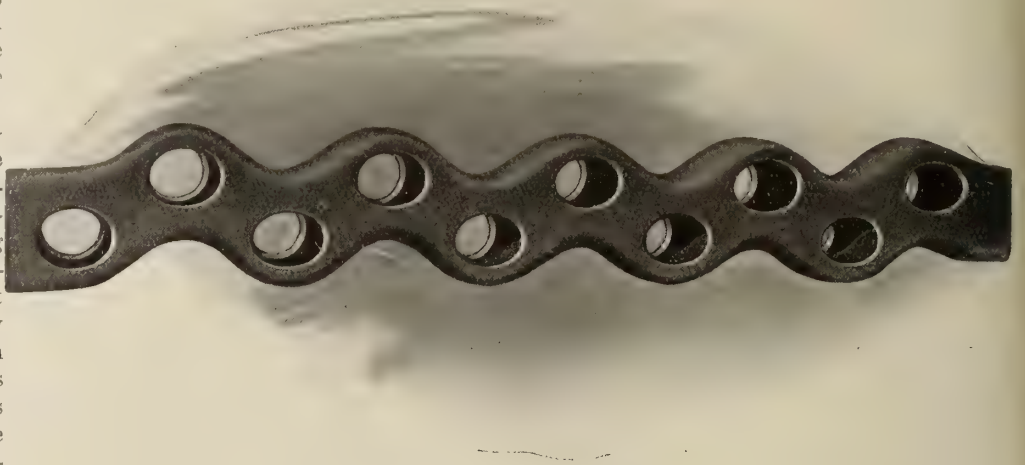


FIG. 2. FORGED STEEL HEADER.

Cross Drum Type Boiler.

Figure 3 illustrates the cross drum type of sectional water tube boiler, this pattern being particularly adapted for installation in office buildings and hotels, departmental stores and boiler rooms, generally, where the head room is limited or where a boiler or its parts have to be introduced through narrow passage ways and restricted openings. The headers are made of forged steel, and finished in the same manner as for the standard pattern. With the sole exception of position and mode of connecting the steam drum, the boiler possesses the same distinctive features as regards circulation, furnace capacity and general working qualities as the other type.

Generally, the boilers as above outlined and described may be considered as a decided and important advance in steam engineering practice and manufacture as far as Canada is concerned, and are sure to attract the attention and serious consideration of engineers and others interested in steam generation.

We understand that the makers are already receiving numerous enquiries for this boiler, and we hope shortly to be able to publish particulars and data as to its service performance.

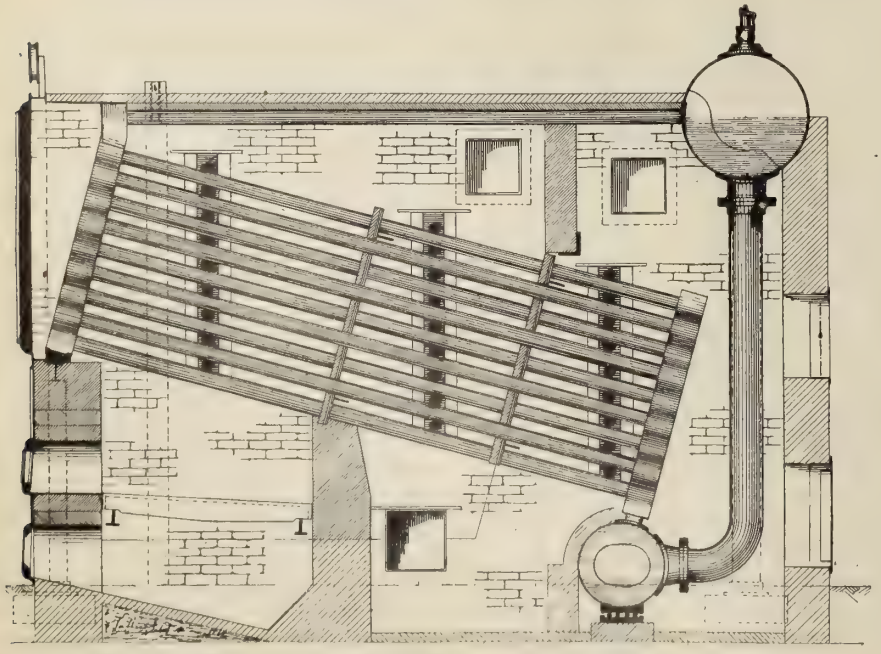


FIG. 3. GOLDIE & McCULLOCH CROSS DRUM SECTIONAL WATER TUBE BOILER.

Super-heater Equipment.

The super-heater equipment, supplied with these boilers when required, is shown in Fig. 1, and consists of two headers or manifolds which receive and deliver the steam respectively; connection being made by loops of solid drawn steel tubes with ends expanded into the headers. Provision is made for flooding the super-heaters during the steam raising period, and for drawing same thereafter. An equalizing pipe and valve are also supplied for regulating the temperature of the super-heated steam.

The Fred Thomson Co., Ltd., Montreal, Que., has been incorporated with a capital stock of $100,000, to manufacture electrical machinery, supplies and accessories.

POWER PLANT DEVELOPMENTS

A record of current municipal, manufacturing and general industrial projects, involving steam, gas, oil, electricity, air and water power equipment requirements.

Electrical

Clinton, Ont.—The town now owns an electric plant, and will do its own pumping at the waterworks.

London, Ont.—The sum of $442,573 has been appropriated for the electrification of the London and Port Stanley Railway.

Port Coquitlam, B.C.—Messrs. Purdy and Williamson, of Vancouver, are erecting a sub-station for the Western Canada Power Co.

Westmount, Que. — The Montreal Water and Power Co. will increase their electric light plants and raise their water tank 25 feet.

Estevan, Sask.—The Town will supply day power for the first time this month. There should be a good demand for electric motors.

Regina, Sask.—Construction work on the new city power house in Lakeview will commence at once. The floor area will measure 174 by 120 ft.

Aurora, Ont.—The ratepayers will shortly vote on a by-law to provide for a supply of electric power from the Toronto and York Radial Railway Co.

Russell, Ont.—The ratepayers recently voted in favor of the town erecting an electric light and power plant which will be gone ahead with at once.

Tillsonburg, Ont.—The Tillsonburg Electric Car Co., Ltd., have been granted a bonus by the town and will proceed to build their factory here at once.

Port Dover, Ont.—The ratepayers will shortly vote on a by-law authorizing the installation of a complete new hydro-electric system. Reeve Vyes is in charge.

Shawinigan Falls, Que.—The Shawinigan Water and Power Co., Montreal, are adding to their power plant, the company themselves being builders and architects.

Windsor Mills, Que.—The Canadian Paper Co., have purchased water power in the vicinity, for over 1,000 h.p., from which they will generate power for their mills.

Kelowna, B.C.—By-laws for raising the sum of $1,000 for extending the electric light system and $1,000 for extending the water system will be submitted on July 1st.

Rockwood, Ont.—The Township of Eramosa, Ont., has issued debentures to be applied to secure electric power from the Hydro-Electric Power Commission of Ontario.

River Glade, N.B.—R. A. Corbett, St. John, has been awarded the general contract for the power house for the Jordan Sanitarium. Architects, F. Neil Brodie, St. John.

Orillia, Ont.—The Water, Light and Power Commission are considering the purchase of 48 cluster lights at a cost of $13,000. Engineer Greenwood is making estimates.

Medicine Hat, Alta.—By a vote of 974 to 181 the burgesses of Medicine Hat decided to grant a street railway franchise to Sir Max Aitken. The vote was the largest ever cast on a local by-law.

Berlin, Ont.—The Dominion Tire Company, which is completing a new $300,000 industry in the west ward, has decided to erect a power house to cost $50,000. Work will commence immediately.

Drumbo, Ont.—The villages of Drumbo, Plattsville, Princeton and Brighton, have voted in favor of taking power from the Hydro-Electric Commission, and the final vote of the residents will be taken on July 21st.

Newmarket, Ont.—The ratepayers have voted in favor of the Hydro-Electric System against the proposition of the York Radial, to supply power at $25.50 h.p. if the town spend $12,000 on the distributing plant.

Hagersville, Ont.—The installation of a hydro-electric transformer station at Hagersville is contemplated by the Ontario Hydro-Electric Commission, Toronto. Three 600 horse-power transformers will be required.

McAdam Junction, N.B.—Work is begun on the foundations of the new C. P. R. shops here. The shops are to be run by electric power and a large plant is to be established at McAdam Junction for that purpose.

Kamloops, B.C.—The ratepayers have voted favorably on a proposition to spend $100,000 to extend waterworks, $120,000 to extend electric light system, and the balance of $480,000 for an electric light power plant on the Barrier River.

Windsor, Ont.—The Essex Light and Power Co., understood to be identified with the Detroit Edison Co., are laying power cables across the Detroit River to Sandwich, to distribute power to Essex, Leamington, Kingsville, Harrow and Amherstburg.

Windsor Mills, Que.—The Canada Paper Co., Windsor Mills, Que., have purchased what are known as Kingsey Falls, on St. Francois River, near Windsor Mills, Que., and will erect a dam and power house this summer, and supply electric power for their plant at Windsor Mills.

Estevan, Sask.—The town has contracted with the Dominion Odic Electrical Co., Minneapolis, for the transfer of five acres in the industrial section, upon which the Company must erect within ninety days a completely equipped plant to manufacture their goods and employ 50 hands.

Hamilton, Ont. — The Dominion Power and Transmission Co. will build a $1,000,000 steam auxiliary plant at once on the site of the old power house of the Street Railway. It will have a capacity of 30,000 h.p., with provision for other units. The machinery will be up-to-date, and will include a steam turbine.

Montreal, Que.—The Montreal Light, Heat and Power Co. will build a gas plant of 4,000,000 cubic feet per day, and a central auxiliary steam station, capacity 25,000 h.p., to be increased to 50,000 h.p. The company also contracted with the Cedar Rapids Mfg. and Power Co. for the supply of 60,000 h.p.,

for which they will erect a steel power tarnsmission line.

Berlin, Ont.—The Berlin Steam Heating Co. has offered to sell its plant to the City Light Commission. Owing to the company not being permitted to sell electricity in the city the enterprise is not proving a financial success. The commission has asked the company to place a figure on the plant, and if satisfactory, it is probable steps may be taken to acquire this utility.

Iroquois Falls, Ont.—Details in regard to the new development of the Abitibi Pulp and Paper Co., at Iroquois Falls, show that of the 17,500 horsepower which will immediately be developed, about 15,000 will be used to run 18 ten-ton grinders, and in addition about 3,000 horse-power of electrical energy will be utilized. The building will be completed by December 1.

Ladysmith, B.C.—Fifty miles of new electric tramway will be built on Vancouver Island this year, with Ladysmith as the hub of the new system, according to Capt. Montague Yates, of Victoria, general manager of the new Vancouver Island Hydro-Electric and Tramway Co., which is to start active operations this month. Extensions are planned to Chemainus, Duncan, Nanoose and Nanaimo.

Toronto, Ont.—The Hydro-Electric and Power Commission have issued instructions to go ahead with the Chatham-Windsor section of the high tension line from St. Thomas to Windsor. The commission will erect transformer stations at Niagara Falls, Dundas, Toronto, Berlin, Stratford, owing to the increased demand for power. Engineers were instructed to prepare estimates for the cost of constructing, equipping and operating an electric railway through Markham, Stoufville, Unionville, Fort Perry, Uxbridge, etc.

Municipal

Galt, Ont.—The ratepayers will be asked to vote $60,000 to carry out the proposal for a new trunk water main.

Regina, Sask.—A power house and laundry at a cost of $10,000 are planned by the city council. It will be of structural steel, reinforced concrete and brick construction. M. R. Darrack, Western Trust building, is the architect.

Lindsay, Ont.—The ratepayers have passed the by-law granting $10,000 to the Canadian Boving Co., Toronto, who have assumed the property and plant of the Madison-Williams Co. manufacturers of hydraulic and other machinery.

Estevan, Sask.—The Dominion Odic Company, Ltd., has signed a contract for the town to erect a building to manufacture electric motors. The plant will cost about $50,000, and the company is said to have a capital stock of $1,000,000.

Toronto, Ont.—The city has engaged experienced men to value the Toronto Street Railway and the Toronto Electric Light Co., so that the citizens will be able to vote on the proposed purchase of these utilities when the matter comes before them.

Water Works

Paris, Ont.—The town council contemplate the purchase of waterworks supplies.

St. John, N.B.—The commissioners will extend the Marble Cove sewer along the shore to the river, at a cost of $10,000.

Winnipeg, Man.—The Anglo-American Filter Co. will erect a filter plant at a cost of between $15,000 and $20,000.

New Westminster, B.C.—The council have approved of steel pipes at a cost of $8,800 for supplying water to Milliardville.

Port Edward, B.C.—A waterworks system to cost $30,000 is being planned for Port Edward.

Sudbury, Ont.—The town has passed a by-law authorizing the expenditure of $17,325 for waterworks extension.

St. Alexis, Que.—On May 20th the ratepayers voted on a scheme to spend $33,000 on a waterworks and sewerage system.

Burlington, Ont.—The village council are planning a sewerage system, the engineer in charge being J. J. McKay, Hamilton.

Port Coquitlam, B.C.—On May 15th the ratepayers passed by-laws authorizing the expenditure of $100,000 on the water works.

Brighton, Ont.—A large force of men are employed installing a waterworks system here. The first sod was turned by the Reeve.

Watrous, Sask.—The ratepayers have passed by-laws providing $70,000 for completion of the waterworks and sewerage system.

Esquimault, B.C.—Esquimalt is contemplating solving its sewage problem at an estimated cost of $500,000. Plans are being prepared.

Merriton, Ont.—Plans for a $35,000 sewerage system have been approved by the Board of Health. Seven miles of sewer are to be laid.

New Westminster, B.C.—A by-law will be submitted to the ratepayers shortly, providing for the expenditure of $45,000 on water works.

St. John, N.B.—A contract for the waterworks supplies at a cost of $8,700 has been given by the city council to John Birch Co., London, Eng.

Lindsay, Ont.—Supt. Hammond has been instructed by the Water Commissioners to proceed with the construction of a new filter, costing $2,500.

Bedford, Que.—The town is considering the construction of a waterworks system and has engaged the services of a consulting engineer.

Timmins, Ont.—The town will bring its water from a source some distance out of town. The engineers are Sutcliff & Neelands, New Liskeard, Ont.

Port Moody, B.C.—The city council will utilize the water from Noon Creek for its future supply. Contracts for a waterworks system will be called shortly.

Point Grey, B.C.—The town will buy the sewer and waterworks at Shaughnessy Heights from the C.P.R.; $324,606 having been appropriated for this purpose.

Ottawa, Ont.—The Private Bills Committee has passed a bill which authorized the city of Ottawa to go to the Gatineau Lake for its new water supply.

Port Coquitlam, B.C.—Engineer Verner has submitted estimates to the council for water mains for Maillardville. The steel mains will cost $8,800, and the cast iron $11,700.

South Vancouver, B.C.—A 1,000,000 gallon pump will be purchased by the Water and Light Committee who will also construct a 100,000-gallon tank and a 750,000-gallon steel standpipe.

Hamilton.—The city council has passed a by-law for $150,000 for waterworks improvements, to include $50,000 for new services; $1,000 for hydrants and $10,000 for meters and installations.

Golden, B.C.—The Canadian Pipe Co. have been advising the Board of Trade concerning the installation of a water system. It was stated that a modern system could be installed for $45,000.

South Vancouver, B.C.—The Water and Light Committee have decided to purchase a 1,000,000 gallon capacity pump and construct a 100,000 gallon wood tank, and a 750,000 gallon steel standpipe.

Medicine Hat, Alta.—Fraser & Chalmers were unable to instal machinery at the waterworks according to contract, for May 1, but will have temporary machinery in place by July 15. The city has agreed to this.

Port Coquitlam, B.C.—Plans and specifications of a preliminary waterworks system are complete, and call for an expenditure of between $20,000 and $25,000, the mains to be 12, 8 and 6 ins. in size. Tenders were opened on Tuesday, June 10th. City Engineer Kilmer.

Montreal, Que.—In view of the fact that Norman M. McCloud, contractor in charge of the construction on the new filtration plant, has protested to the Board of Control that the sub-soil is defective, the Board have appointed three engineers to report on the nature of the ground selected as a site for the filters.

Edmonton, Alta.—The city council have decided that the Rabbit Hills will be the source of the city's water supply. The pumping station will be located nine miles up the river, where the water will be pumped and filtered, and then brought by gravity seven and a half miles. The estimated cost is $3,140,000.

Winnipeg, Man.—$14,144,903 is the estimate of City Engineer Ruttan for bringing a supply of water of 25,000,000 gals. per day from Shoal Lake to Winnipeg, by gravity system. There will be two pipe lines. The first line would be finished in four years if rushed. The second is intended as a standby in case of accidents. If only one be built, it is recommended that a storage reservoir of 25,000,000 gals. capacity be constructed.

Refrigeration

Coquitlam, B.C.—The Mt. Coquitlam Asylum is being equipped with a 25-ton refrigerating machine, furnished by the York Co., York, Pa.

Nanaimo, B.C.—Quesnell & Son are installing a 5-ton refrigerating plant, furnished by the Armstrong Machinery Co., Spokane, Wash.

Vancouver, B.C.—The Turner Dairy is installing a 5-ton refrigerating plant, supplied by the Armstrong Machinery Co., Spokane, Wash.

Calgary, Alta.—The P. Burns Co., Ltd., meat packers, contemplate building an abattoir and cold storage plant at South Fort George, B.C.

London, Ont.—The London Sanitarium has installed a 2-ton "York" vertical, single-acting refrigerating machine, by the Kent Co., Montreal .

Vancouver, B.C.—The Valley Dairy are installing a 5-ton refrigerating plant, furnished by the Armstrong Machinery Co., Spokane, Wash.

Cranbrook, B.C.—The 41 Market Co. have awarded the Armstrong Machinery Co., Spokane, Wash., for installation a 5-ton Alaskan refrigerating machine.

Toronto, Ont.—The Paterson Candy Co. are having their candy factory equipped with a 17-ton refrigerating machine furnished by the York Co., York, Pa.

Montreal, Que.—The Engineers' Club has installed in its club house a 4-ton "York" refrigerating machine and 1¼-inch direct expansion piping. The Kent Co., Montreal, were the contractors.

Vaudreuil, Que.—The Canadian Explosives Co., of Montreal, is having its dynamite factory equipped with a 30-ton vertical refrigerating machine, furnished by the Frick Co., Waynesboro, Pa.

Fredericton, N.B.—Searle & Lamson, Ltd., plan the erection of a refrigerating and cold-storage plant, to cost about $50,000. The building will be 90 x 30 ft., and of concrete construction throughout.

Toronto, Ont.—S. Caulfield & Sons, dairymen, have installed a 6-ton refrigerating machine, with 1¼-inch direct expansion piping, for cold storage rooms. The York Co., York, Pa., supplied the machinery.

Toronto, Ont.—The new municipal abattoir and cold storage plant now being erected at Toronto, Ont., Canada, is to cost about $350,000. Wm. R. Perrin & Co., abattoir engineers, Chicago, Ill., made the plans, and will supervise the erection.

Saskatoon, Sask.—The Saskatchewan Abattoirs, Ltd., capital $200,000, plan the erection of an abattoir and cold storage plant, also a soap factory, two storeys high, measuring 150 x 50 ft. W. C. Smith, president of the Standard Soap Mfg. Co., St. John's, Nfld. is interested. The cold storage plant will cost $100,000.

Arctic Ice Machine Co.—The Arctic Ice Machine Co., Canton, O., have opened new Western offices for the purpose of covering the States of Utah, Idaho and Nevada. The new offices are located at No. 1114 Newhouse Building, Salt Lake City, Utah, and at 1329 25th Street, Ogden, Utah and will be in charge of H. H. Keener who is a practical experienced ice machine man and has already erected a number of Arctic plants for his customers in the territory named. The Arctic Ice Machine Co. further announces that they have made arrangement whereby their interests in and about Philadelphia, Pa., will be handled by John H. Gold at 1550 N. 62nd Street, Philadelphia. Mr. Gold is an experienced refrigerating engineer.

Contracts Awarded

Bowmanville, Ont. — The Canada Foundry Co., Ltd., Toronto, will supply machinery for the pump house at a cost of $4,680.

Windsor, Ont.—The Kerr Engine Works, Walkerville, have been awarded the contract by the city council for 50 brass water main valves.

Edmonton, Alta.—The city has awarded to the Packard Electrical Co., St. Catharines, Ont., the contract for four three-phase transformers at $9,520.

Medicine Hat, Alta.—The Western Sales Co., of Winnipeg, has been awarded a contract to instal a water system at a cost of $50,000, for the Dunmore Development Co.

Quebec, Que.—A contract for the Chateau d'Eau in connection with the new Quebec Water Works has been awarded to the Lauzon Engineering Co., of Levis, Que., for $21,300.

Kincardine, Ont.—The Waterworks and Electric Light Commission have placed an order with the John Inglis Co., Toronto, for a steam pump, costing $17,035, to be delivered within six weeks.

Winnipeg, Man.—The National Meter Co., Chicago, have been awarded the contract for water meters by the Board of Control. The price is $11.75 each for half-inch meters, and $29.25 for one inch meters.

Heap and Partners, Ltd., Montreal, have been awarded a contract by the Acadia Sugar Refining Co., for supply-Acadia Sugar Refining Co., for supply of 34 Rees-Roturbo pumps, ranging in size from 10 to 180 horse-power. They are to be used for pumping liquids of various specific gravities.

Moncton, N.B.—The city has awarded Babcock and Wilcox, Limited, Montreal the contract for supplying a strainer, and the John McDougall Caledonian Iron Works Co., Montreal, the contract for supplying a Venturi water meter.

Montreal, Que.—The contract for the enlargement of the Montreal city aqueduct has been awarded to the Cook Construction Co., of Sudbury, for $2,322,-562 The company has headquarters in Canada at Sudbury, and in the United States at St. Paul, Minn.

Sault Ste. Marie, Ont.—The H. E. Talbot Construction Co. has been been awarded the contract for the construction of the power dam, power house and paper making plant of the Donnacona Paper Co. at Donnacona, The contract amounts to $300,000.

Regina, Sask.—The city has awarded the following contracts for waterworks supplies:—Contract B—Canadian Iron Corporation, 1000 Talbot Street East, St. Thomas, Ont. Contract C—Jas. Robertson & Co., 176 Pacific Avenue, Winnipeg. Contract C—Pig lead, J. A. Ashdowne Co., Bannatyne Avenue East, Winnipeg. Contract D—Drummond McCall Co., Ltd., 23 Victoria Square, Montreal.

Regina, Sask.—The Council has awarded the following contracts for sidewalks, sewer and water mains: Bitulithic contracting and Paving Co., 72,093 yards paving, $216,297; The National Pavers, 69,771 yards asphalt paving, $193,847; The Regina Foundry Co., 250 manhole covers and fittings, $4,250. Sewer extension contracts went to R. J. Lecky & Co., H. G. McVean, John Brodt, and Sykes Co., of Neepawa.

Montreal, Que.—The Western Power Company, Limited, have awarded the contract to the Escher, Wyss & Company of Zurich, Switzerland, for supplying two additional 13,000 h.p. double Francis turbines, the Canadian General Electric Company the contract for two additional generators of corresponding capacity, and the Canadian Westinghouse Company, Limited, for switchboards and accessories to complete the power house extension.

Swift Current, Sask.—The city will discard its gas producer plant and will install a steam plant. The old power house will be used as a pumping station. Contracts have been let for 300 h.p. Babcox and Wilcox watertube boilers, at $15,460; for a 300 h.p. and a 500 h.p. high-speed reciprocating engine to Messrs. Goldie & McCulloch, of Galt, Ont., at $16,195; and for a 200 h.p. and 400 h.p. a.c. generators to the Allis-Chalmer-Bullock Co., of Montreal, at $11,500. The engineers in charge of the work are John Maddin, Winnipeg, and the city engineer, Geo. D. Mackie.

Tenders

Winnipeg, Man.—Tenders will be received by the Board of Control up to June 20th for the supply and installation of machinery, etc., for a refrigeration plant at the municipal hospitals. M. Peterson, sec.

Toronto, Ont.—Tenders will be received by the undersigned till June 20, in bulk or separately, for the following departments in connection with the Hudson's Bay Co. departmental store, Vancouver, B. C.:—Steam-fitting, electric wiring, plumbing, refrigeration, vacuum cleaning, sprinklers, steam-driven generating units, turbine generating units, steel smoke stack, suction ash conveyor, pneumatic cash tubes. Burke, Horwood & White, architects, 28 Toronto St., Toronto.

Trade Gossip

The Canadian Fairbanks-Morse Co., Ltd., have opened a branch office and show room at 325 Simpson Street, Fort William, Ont., with H. R. Wilkes and W. R. Vollett as representatives .

Chamberlin Co.—The business heretofore conducted under the name of Wm. M. Chamberlin, Trade and Technical Journal Advertising, at 71 Griswold Street, Detroit, will hereafter be known as Chamberlin Company, Technical Publicity, with larger and more attractive offices in the Free Press Building.

Hillcrest Collieries Output.—Directors of the Hillcrest Collieries, at a meeting held this week, ratified a contract for the sale of the entire output of the mines for a period of five years. The contract was entered into with the Canadian Pacific Railway, which has been taking about a third of the output for some time back, and was made at a satisfactory advance in selling price.

Roper, Clark & Co., manufacturers' Agents, Coristine Building, Montreal, have recently obtained two new agencies, one the Premier Accumulator Co., of Northampton, England, and the other, the Independent Electric Co., of Milwaukee, Wis. This firm already represent H. W. Ward & Co. machine tool makers, Birmingham, Eng., and Bruce, Peebles & Co., Edinburgh, Scotland.

Graton & Knight Mfg. Co.—In accordance with its policy adopted a number of years ago the Graton & Knight Manufacturing Co., of Worcester, Mass., well-known oak leather tanner and belt makers, recently held a salesmen's convention at its main factory in Worcester. This convention was attended by the company's salesmen from all parts of the country, and the various sessions were devoted to an inspection of the factory, to a study of methods of manufacture, as well as to the sale and application of the company's products. At the conclusion of the convention a banquet was served at which more than 100 officers, salesmen and other employees were present. A feature of this year's meeting which was especially inspiring to those in attendance was the presence of Henry C. Graton, founder of the business. To a very large extent, the phenomenal growth of the factory, from a small belt shop in 1851 to a plant that is one of the largest of its kind in the world, is to be attributed to the sagacity and wisdom of Mr. Graton and his early associates, and to the persistent adherence of the firm to the policy early adopted of endeavoring to meet the steadily increasing demands for the most serviceable leather belting.

The Sherbrooke Machinery Co., Ltd., Sherbrooke, Que., have arranged with the Wilbraham-Green Blower Co., of Pottstown, Pa., whereby they are to manufacture their blowers and exhausters for the Canadian market. The Wilbraham-Green Blowers and Exhausters are very well known in the United States and Canada, and the Sherbrooke Machinery Co. will undoubtedly be very successful in placing this line in Canada.

The Mesta Machine Co., Pittsburgh, Pa., have introduced a new valve (Iverson Patent), which they are fitting to their blowing engines and air compressors. The valve is automatic and of the multi-ported plate type. There are no flash ports and no large clearance spaces. The valve needs no attention and no oiling, and consists of a thin annular steel plate which is guided without friction by a volute spring; the latter furnishing at the same time the small force which is necesary to start the closing motion of the valve. An engine can be operated at 80 R.P.M. instead of 40 R.P.M., which is about the average speed of Blowing Engines. The steam end is not only more economical, but the engine has twice the capacity. The following are the principal advantages claimed for this valve. Simplicity of air end; no valve gear required; greater volumetric and mechanical efficiency; no wear; practically no repairs; no lubrication; practically no at-

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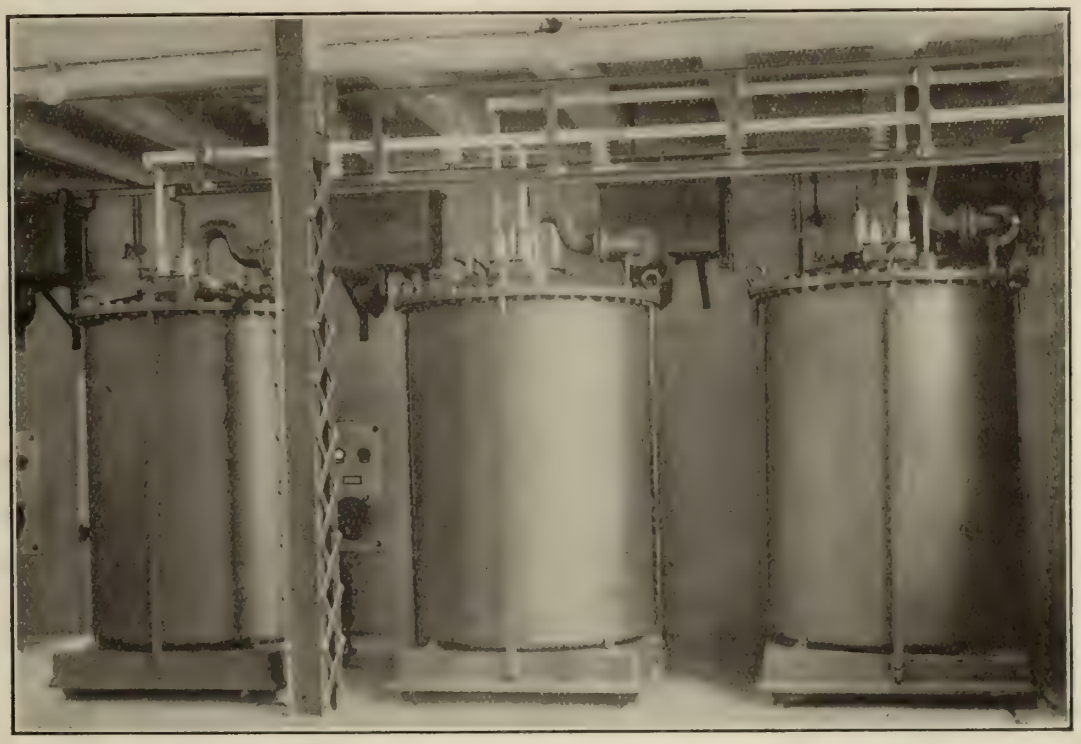

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Four of the above were a repeat order after the first bank had been in successful operation for eighteen months.

We also supplied the whole of the switching apparatus, lightning arresters and two 750 h.p. motor generator sets.

Attention is especially drawn to the expansion vessels connected by a pipe to the top of the transformer case. Our transformers are completely filled with oil including this connecting pipe, and part of the expansion vessel, expansion and contraction of the oil taking place in the latter.

By means of the peculiar shape of the connecting pipe the hot oil by the time it passes to the expansion vessel is sufficiently cool so that no hot oil comes in contact with the air, and no moisture can enter the transformer itself. This arrangement also keeps the oil in perfect condition and prolongs the life of the transformer.

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tendance; noiseless operation up to the highest speed, and reliable and economical up to 100 R.P.M.

Personal

Geo. C. Burnham has severed his connection with the firm of Kilmer, Pullen & Burnham, Ltd., Toronto.

John O'Neill, city engineer of Fredericton, N.B., recently tendered his resignation to the City Council.

Clyde L. Huff has been engaged by the town of Athabasca, Alta., as town engineer, at a salary of $2,000 a year.

H. H. Couzens, the new manager of the Toronto Hydro-Electric System, will receive $12,000 per annum, under his three-year contract.

H. N. Ruttan, city engineer of Winnipeg, has been elected a member of the council of the Institution of Civil Engineers, London, Eng.

James Veitch, formerly of the Bruce, Peebles Electric Co., Edinburgh, Scotland, and latterly on the staff of the Donaldson Liner S.S. Cassandra, has joined the engineering staff of Chas. F. Gray, consulting electrical engineer, Union Trust Building, Winnipeg.

George H. Tod, Manning Chambers, Toronto, who is the Canadian representative for Ashworth-Parker engines, Bennis mechanical stokers and Broadbent's cranes, capstans, etc., is making a six weeks' tour of Western Canada. Mr. Tod recently opened a Western office at 601 Union Bank Building, Winnipeg.

C R. Murdock, of the firm of Chipman & Powers, engineers, Toronto, has been in Watrous, Sask, superintending work on water works, and sewerages, but has returned to High River, where he is engaged on a similar class of work. He stopped en route at Kerrobert which town is spending $865,000 on water works system.

Archibald Currie, C.E., at present city engineer of Westmount, has been chosen by the Board of Control of Ottawa to fill the position of city engineer in that city. Mr. Currie has already signified his intention of accepting the post, and will take up his new duties on June 20. His salary will be $5,000 per year, to be increased to $6,000 after the first year, if the civic authorities are satisfied.

H. H. Couzens Honored.—A number of personal friends of Mr. H. H. Couzens, on his leaving Hampstead to become general manager of the Toronto Hydro-Electric System, conspired to give a dinner in his honor. The event took place at the Whitehall Club recently, and was quite informal. Mr. J. F. C. Snell took the chair, and conveyed to Mr. Couzens a quadruplex installation of induced draught apparatus for export to the Dominion.

D. MacD. Campbell, city engineer of Sydney, N.S., tendered his resignation to the Board of Trade recently, and it was accepted. Poor health is given as the cause, and Mr. Campbell will not enter the services of any other corporation, but will engage in private work. Mr. Campbell entered the service of the city as a member of the city engineer's department in 1900. For several years he was assistant to Mr. Yorston, and on the latter's resigning in 1908, succeeded to the position.

Henry J. Fuller, president of the Canadian Fairbanks-Morse Co., has been elected vice-president of Fairbanks-Morse & Co., whose head office is in Chicago, Ill. Mr. Fuller will have charge of the Eastern business of the Company, with headquarters in New York, but will continue as president of the Canadian Company, giving it his first consideration and spending a large portion of his time in Canada. He will leave shortly on a trip of inspection of the branches in the West.

Lawford Grant, president and managing director of the Canadian Insulated Cables, Ltd., has resigned to take an important executive position with Eugene Phillips Electrical Co., of Montreal. Mr. Grant has been thirteen years with the British Helsby Cables Co., which is the parent of the concern which he formed in Canada about six years ago. He will retain his official position as president of the company he is leaving. Mr. Grant has traveled the Dominion over, and has made many friends. Before coming to Canada, he carried out some important electrification work for the British Government at the Island of Malta.

W. F. Graves, formerly superintendent of tracks of the Chicago City Railway Co., took up his duties recently as chief engineer of the Montreal Tramways Co. Mr. Graves began his civil engineering work with the Chicago, Rock Island and Pacific Railway in 1885. He remained with this company for five years, working in various capacities and finally gaining the title of engineer of maintenance of way of the Southwestern district for the Company. Later he went with the Missouri Pacific Railway as assistant engineer of maintenance of way, which position he held for three years. He then became connected with the South Side Elevated Railroad, of Chicago, as engineer of construction, remaining with this Company for four years. He then took up his present position as superintendent of track of the Chicago City Railway Co., and has been thus engaged the last six years. Mr. Graves is a member of the American Society of Civil Engineers, the Traffic Club of Chicago, and the Chicago Engineers' Club.

Obituary

William Irvine, assistant waterworks engineer, Parry Sound, Ont., fell dead at work on May 25th, while in temporary charge of the pump house during the absence of Mr. Murray. He was about 60 years of age.

Malcolm Ross, chief engineer at the municipal waterworks pumping station, Fredericton, N.B., died on Saturday afternoon, May 10, after a long illness. He was born in Maugerville and was in his 78th year. He entered the employ of the city as engineer in the water department when the waterworks was installed, about thirty years ago.

Catalogues

H. W. Johns-Manville Co., with offices practically everywhere, make asbestos, magnesia and electrical products. They make so many lines. For the benefit of the consumer they have issued a folder containing a list of goods made in their plant, with a postcard attached, handy to mail for particulars.

The Fort Wayne Engineering & Mfg. Co., Fort Wayne, Ind., have issued a new catalogue, No. 2024, which describes fully their well known "Paul Water Systems." These systems include complete pumping outfits for deep and shallow wells, pneumatic pumps, and controllers. Full particulars are given of each type, also a considerable amount of interesting data.

"**Is There Rosin in Cling-Surface?**" is the name of a new 12-page booklet just issued by the Cling-Surface Co., Buffalo, New York. To prove that there is no rosin in this belt preparation the manufacturers show several fac-simile reports of chemical analyses made in England and Germany. Professor Orndorf, of Cornell University, is also quoted. The booklet lists many prominent users.

The Joseph Dixon Crucible Co., Jersey City, N.J., have just published a new booklet entitled "Graphite for the Boiler." It, of course, deals with no new discovery, for graphite has been sold for scale removal purposes from boilers for many years; simply, stating in as few words as possible the salient

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A feature made possible by the use of compressed air as the feeding force. The "PHILADELPHIA" is equally positive in action in whatever position placed, and will —

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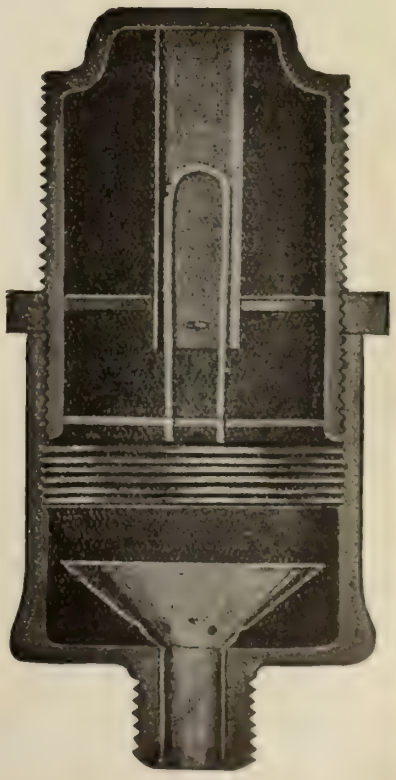

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Peterborough, - Ontario

The advertiser would like to know where you saw his advertisement—tell him.

features of this product. No startling claims are made, for the subject is too old to be longer sensational.

"The Blow-off" is the title of a breezy magazine published by Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa., makers of Simplex-Caskey Valves for hydraulic service, and the Simplex pipe-joint clamp. The Nelson Valve Co., of the same address, make "Nelson" valves. This magazine, of course, tells much about this firm's valves, etc., but it also contains lots of general interesting matter, even giving a page to jokes, and another to "Little Thoughts on Big Problems."

Neptune Belting gets its name from the fact that it is especially adapted for damp and wet places. Some people use cotton or rubber belts in damp places, but it is claimed by makers of "Neptune" that it will outlast three belts of rubber or cotton. It has been run in rain, snow and sun, submerged in water for hours at a time, and frozen solid, yet the laps did not loosen, nor did the belting come apart between the plies. It is made by the Graton & Knight Mfg. Co., Worcester, Mass.

Ronald Trist & Co., Ltd., London, Eng., manufacturers of the "Thermofeed" Boiler Fed Regulator and Governor have sent us a copy of their catalogue, which describes in a clear manner the design and application of the apparatus. It is claimed that with any boiler where the "Thermofeed" is fitted, the variation in water level will not exceed ⅛ in. The device is simple in construction and can be fitted to any type of boiler. Catalogue will be sent free on request to anyone interested.

"Our Old Friend in a New Light" is the calendar intimation received of the absorption by the Canadian Allis-Chalmers Co., Ltd., of the Allis-Chalmers-Bullock Co., Ltd., Montreal, Toronto, Winnipeg, Vancouver, etc. A beaver colony at work, entitled "The First Engineers," has furnished the pictorial feature of the latter company's calendar for a number of years back, and in the present instance, the glow from a forest fire shows the industrious animals in a "New Light," without doubt. The new organization is to be commended for the enterprise shown in preparing such an effective announcement.

The United States Electrical Tool Co., Cincinnati, O., have favored us with a copy of catalogue "H." It deals fully with electrical hand or breast drills, electric radial drills, bench drills, electrically driven grinders, etc. These are machines which may be taken to the work, and the lamp socket is the only power house required. Space cannot be given here to tell of the excellent photographs in this catalogue, showing how these tools may be used as time-savers. At the end are general instructions on how to take care of electric tools. The uses to which electric tools may be put are so many that no one should be without this booklet.

The Federal Graphite Mills, Cleveland, Ohio, have issued a booklet entitled "Actual Experiences of Engineers with Boiler Graphite." Inserted in the booklet are to be found leaflets containing instructions and suggestions for operating and cleaning steam boilers with "Federal Graphite"—the name by which the firm's product is known, and also information relative to the daily costs of treatment. All operating engineers are interested in the subject of boiler scale prevention, and such data as is made available through the medium of the above-mentioned literature may be acquired and practised by all who care to avail themselves of it.

Noiseless Gear Driving.—A 56-page book issued by the New Process Gear Corporation, Syracuse, N.Y., contains sound engineering arguments for rawhide gears, proves that they are of important economic value in any plant where high speed gears are used, gives much transmission data, and is profusely illustrated with photographs of actual installations. Sections of eleven types of rawhide gears are shown, and prices on nearly 2,000 sizes of pinions are given, which are either in blank or cut and ready for use. In the back of the book a few pages are devoted to the large metal gear cutting departments of the above company. A free copy will be mailed on request.

"Elementary Internal Combustion Engines" by S. W. Kershaw. Cloth, 171 pages. 5 in. x 7¼ in. 117 illustrations and diagrams. Published by Longman Green & Co., London, and by Renouf Co., Montreal. Price, 75c. This book, while primarily intended as an Elementary Manual, contains a lot of information which will be very useful to Plant Engineers. The first eight chapters are devoted almost entirely to Gas Engines and Gas Producers, special features of several well known types being described. One chapter is devoted to Heavy Oil Engines, among these being the Diesel Engine. Chapter XI is devoted to marine oil engines and Chapter XIII contains some useful data on engine efficiency. The author has treated his subject in a clear and practical manner. The descriptions are principally of British practice, but the book will lose nothing on that account, as none but the best types are referred to.

Federal Boiler Graphite

The one logical solution of your Scale troubles, at a daily cost of 2¼c per 100 h.p.

Here's the way "Federal" is sold

(Copy of our 60 Day Trial Order.)

Gentlemen:— Date .....

Please ship us

Bbl. (400 to 500 lbs.) .....@ 10c lb.
½ Bbl. (300 lbs.) .....@ 11c lb.
Keg (100 lbs.) .....@ 11c lb.

of FEDERAL BOILER GRAPHITE, f.o.b. Cleveland or Milwaukee, subject to (60) Sixty Days' Trial.

If at the end of that period, same has proven satisfactory, it is to be paid for; if found unsatisfactory the remaining unused portion is to be returned to you AT YOUR EXPENSE, and no charge made us for that used in making the test.

Firm .....

Engr. or Buyer.....

City ..... Province .....

There's no strings attached to trying out "Federal." SIMPLY FILL OUT THE ORDER BLANK. THEN **TEAR OUT THIS ADVT. AND SEND IT TO US TO-DAY** and CONVINCE **YOURSELF** OF THE MERITS OF "FEDERAL" BOILER GRAPHITE.

We've an interesting Booklet and Table of Daily Costs that's free to all that desire more information on Boiler Graphite.

The Federal Graphite Mills

CLEVELAND **MILWAUKEE**

LIBERTY BOILER TUBE CLEANERS

ARE THE

BEST POSSIBLE INSURANCE

AGAINST BOILER ROOM ACCIDENTS. Even a light coating of scale on the tube prevents the water from coming in contact with the metal, and the intense heat to which boiler tubes are subjected burns out the metal and an explosion is liable to happen, which frequently results in the loss of life.

LIBERTY CLEANERS are not only a safeguard against accidents of this nature, but are a **remunerative investment.** They will save in fuel their purchase price every month.

If you have been experimenting with other types of cleaners which have failed to make good, do not put the **Liberty** in the same class, but let us send you one on trial, to prove their superiority and show you what **a real Cleaner** can do.

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Liberty Manufacturing Company

6904 Susquehanna Street **PITTSBURGH, PA.**

Canadian Representatives:
Williams & Wilson, Ltd., Montreal. · A. R. Williams Machinery Co., Toronto and Winnipeg.

T is
W hat
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N eeded

to protect every plant that draws its water supply from lakes, ponds or rivers.

A six-hour catch of fish, leaves, etc., made by one basket of a Twin Strainer.

S uch
T roublesome
R ubbish
A bounds
I n
N early
E very
R iver or
S tream

and the only convenient and efficient way to remove it from your water supply is with a Twin Strainer.

The TWIN STRAINER has two straining baskets and is made so that either one of the baskets may be cut out of the line at any time for cleaning, by simply shifting two valves.

If you are not acquainted with the Twin Strainer write for our catalog. It's ready for you.

ELLIOTT COMPANY

6902 Susquehanna Street, **PITTSBURGH, PA.**

CANADIAN REPRESENTATIVES;

Williams & Wilson, Ltd., Montreal. A. R. Williams Machinery Co., Ltd., Toronto and Winnipeg.

The advertiser would like to know where you saw his advertisement—tell him.

"All Famous" is the title of a rather unusual pamphlet being distributed by the Heine Safety Boiler Co., of St. Louis Mo. This pamphlet derives its title from the fact that Heine Boilers are in use by companies having trade marks which are very well known as for instance Victor Talking Machine, Gold Metal Flour, Budweiser Beer, 57 Varieties of Food Products, N.Y. Central Lines, Etc. These trade marks are attractively arranged on the cover of the pamphlet, surrounding the trade mark of the Heine Safety Boiler Co., "Helios," the inference being that the merit of the various trade marks reflects upon the Heine trade mark. Within the pamphlet, there are reprinted a number of advertisements, each one referring to one of the well known trade marks, and stating the character and size of the boiler equipment in use by the company. The pamphlet also contains several advertisements on Heine Superheaters, pointing out important advantages of this type of superheater, such as the close temperature regulation, the absence of necessity of flooding, the impossibility of danger from excessive superheat, etc. Copies of this pamphlet will be found of interest and may be obtained upon application to the Heine Safety Boiler Co., of St . Louis, Mo.

A New Paper Mill Engine is the title of a 16-page pamphlet, size 6 x 9, recently issued by the American Engine Co., Bound Brook, N.J. This pamphlet describes and illustrates the new American ball four-cylinder paper mill engine. Engines of this design have a wide speed range—that is, 8-1 and even 10-1, and may therefore be coupled directly to the variable speed shafting without immediate belts and pulleys for speed changing. The second feature of this engine is the especially designed American ball speed control mechanism. This comprises two governors—one an automatic engine stop and the other the variable speed governor, and also a friction device for changing the speed of the variable speed governor. For paper mill service it is very essential that speed surges be eliminated, because sudden changes in speed cause uneven thickness of the paper as well as breakage of thin delicate paper. Besides describing and illustrating the American ball four-cylinder mill engine, drawings are also shown of the two cylinder angle type speed engine, also of the two-cylinder horizontal variable speed paper mill engine. Copies of the pamphlet may be had on application to the American Engine Co., of Bound Brook, N.J.

Dodge Mfg. Co., Ltd., Toronto.—The latest edition of the general catalogue of the Dodge Mfg. Co., Toronto, Montreal and leading cities of the Dominion, covering power users', mill engineers' and architects' requirements, has come to hand, and, needless to say, is quite in conformity with the high standard of excellence, which the above firm maintain in their every product. Some months ago we published a descriptive article dealing with the plant and product of the Dodge Mfg. Co., and to those in possession of that issue a copy of the catalogue under review will be found a useful supplement. A perusal of the catalogue indicates that the company maintain a large and highly-trained engineering staff, and that the various departments are controlled by men expert in their particular line. It is impossible in the limited space at our disposal to attempt even to enumerate the catalogue contents, and were we to do so, the proceeding would seem superfluous, in view of the fact that "Dodge" is known to embrace everything pertaining to power transmission material, combined with quality, quantity and despatch. The catalogue is attractively and strongly bound in stiff covers, and contains large clear cut illustrations on almost every page of the multitude of specialties produced, together with the tabular and other data relating thereto. In the front pages are shown a bird's eye view of the works at Toronto and a photograph of the firm's eastern warehouse at Montreal, while at the rear are placed the telegraph ciphers for ordering individual products and miscellaneous tables useful for mechanical calculations, etc. Those interested or engaged in the equipment, installation and operation of transmission machinery should secure a copy .

Book Reviews

"Kinks." In Patent Law and Practice is the title of an interesting little pamphlet which we have received from the Detroit Patent Bureau. It contains some valuable information for those who are considering taking out Patents. The present is the 2nd edition.

"Worm Gearing," by Hugh Kerr Thomas, A.M.D.M.E., 84 pages, 6x9 inches, 33 illustrations and diagram. Published by the McGraw-Hill Book Co., New York and London. Price, $1.50 net. This is a very exhaustive work on the subject of worm gears. The principles involved in the design of worm gearing are fully described, especially with regard to its application to automobile rear axles, as a more efficient method of driving than with bevel gears. The data given is for the most part original, and obtained from experiments. The subject although complicated has been, by the use of elementary mathematics, treated as simply as possible.

"Steam Boilers" by E. M. Shealy, 350 pages 6 x 9 inches, 185 illustrations. Published by the McGraw-Hill Book Co., New York. Price $2.50 net. The author is Assistant Professor of Steam Engineering at the University of Wisconsin, and wrote the book primarily for students . It will, however, be found useful by firemen and those in charge of boiler rooms, as it is written from a practical standpoint, the operation rather than the design of boilers being the principal feature, although the chapter on boiler calculations covers the latter phase concisely. The subject is treated in a comprehensive manner, various chapters being devoted to such matters as fuels, stokers, feed water heaters, properties of steam, actual and equivalent evaporation, etc. This is one of the best books on the subject that has appeared for some time, and it should be in the hands of all interested in boiler plants.

"The Modern Gasoline Automobile," by Victor W. Page. 652 pages, 5½ x 8½. Cloth. 500 illustrations and diagrams. Published by Norman W. Henley Publishing Co., New York. Price, $2.50. This is a new work devoted entirely to the latest practice in gasoline automobiles and their component parts. All matter of an historical nature has been wisely eliminated, neither has any reference to steam or electric driven cars been made. All the most modern devices and systems, as adopted by the leading manufacturers, are clearly illustrated and described. The sectional and extra drawings of the engines and various fittings are carefully drawn and clear. The book is written in a practical manner, being free from any highly technical data, and should be extremely useful for owners of cars, engineers and others engaged in the automobile industry.

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WATER GAUGE GLASSES
Stand in a Class by Themselves for Quality, Efficiency and Economy
A trial will convince you. Write for Catalog
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(Canadian Representative)

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Those who wish to sell or buy a business, obtain competent help, connect with satisfactory positions or secure aid in starting new enterprises, should not fail to use the Want Ad. Page of The Power House.

Do you want to sell or buy a second hand engine or any other equipment? Let The Power House pick out a seller or buyer for you.

There is always some one looking for just such proposition as you have to offer.

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LIBERAL COMMISSIONS TO DEALERS AND others handling Vulcan Soot Cleaners; applied to all types of boilers. Vulcan Tube Cleaning Systems, Limited, 42 Craig St. West, Montreal. (4tf)

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ENGINEER—1ST CLASS, B.O.T. AND STATIONARY certs. 19 years' experience in steam, electric and heating plant; good machinist and fair draughtsman. Good references. Apply Box No. ..., The Power House, 143 University Ave., Toronto.

BUSINESS CHANCES

WANTED—EVERY ENGINEER TO GIVE US a chance to figure on electrical repairing. Don't worry about how far away you are. From Halifax to Vancouver is our field. The Mead Electric Co., Unity Building, Montreal, Que.

WANTED — EVERY POWER HOUSE IN Canada to remember that C. E. Shedrick, Craig Street West, Montreal, is still repairing measuring instruments, both switchboard and portable. Twenty-five years' experience in repairing all kinds and makes on the market. Integrating meters repaired, tested and sealed, and returned on quick time.

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BELTING FOR SALE—800,000 FEET OF best quality leather, rubber, hair and canvas belting, bought from bankrupt manufacturers at 25% to 75% less than the regular value. Also a large quantity of slightly used belting, piping, chains, rails, pulleys, hangers, cotton waste, etc., at very low prices. Send for catalogue. Imperial Belting and Supply Co., 5 Queen Street, Montreal.

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WANTED—CANADIAN REPRESENTATIVE to distribute ice making and refrigerating machinery, internal combustion engines of all kinds, and special machinery of any kind built to order. Cleveland Ice Machine & Mfg. Co., Lorain, Ohio, U.S.A.

THE PROPRIETORS OF LETTERS PATENT No. 127080 relating to "Process of Manufacturing Iron Electrodes for use in Alkaline Accumulators" and No. 127081 relating to "Active Masses for Positive Electrodes of Electric Elements, etc." desire to dispose of the Patents or to grant Licenses to interested parties at reasonable terms with a view to the adequate working of the Patents in Canada. Inquiries to be addressed to the actual proprietors, Svenska Ackumulator Aktiebolaget Jungner, Stockholm, Sweden.

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GOOD STENOGRAPHERS ARE WHAT every employer wants. The place to get good stenographers is at the Remington Employment Department. No charge for the service. Remington Typewriter Co., Ltd., 144 Bay St., Toronto.

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Prompt Attention and Immediate Delivery.

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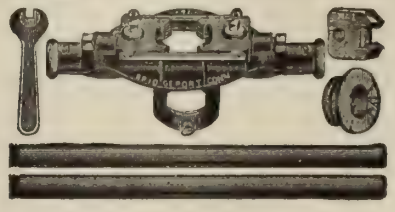

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ARMSTRONG STOCKS
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U.S. BARKEEPERS FRIEND
METAL POLISH
USED AND ENDORSED BY THE LEADING DEALERS
SOLD ALL OVER THE WORLD

THE CANADIAN TURBINE WATER WHEEL — CONSERVE THE WATER POWERS — TRADE MARK.

Chas. Barber & Sons
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WATER POWER EQUIPMENT ONLY
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YOUR FRICTION LOAD

Represents the proportion of the power you are paying for that is used in wearing out your machinery.

Dixon's Flake Graphite

Is friction's greatest foe, because when fed to a bearing with oil or grease, it forms upon the bearing surfaces a permanent, almost frictionless, veneer-like coating which is fully effective in keeping the surfaces apart. A sample sufficient to prove this may be had free on request, with a copy of "Graphite As A Lubricant"—No. 222.

JOSEPH DIXON CRUCIBLE CO.
ESTABLISHED 1827
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¶ An idea that's worth anything at all to a Power Plant man is worth more than two cents.

¶ It might be worth hundreds of dollars.

¶ Every issue of "THE POWER HOUSE" is full of practical, helpful ideas. You ought to be able to sift out four each month that would prove of some use to you. Put a value of two cents on each and your subscription has been paid.

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¶ The date on the label of your "POWER HOUSE" wrapper shows when your subscription expires. One dollar will renew it for a year.

Don't put off Renewing—Do it to-day
Neglect blew up the Boiler

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Incandescent Lamps

First quality lamps in stock in every candle power at lowest prices.

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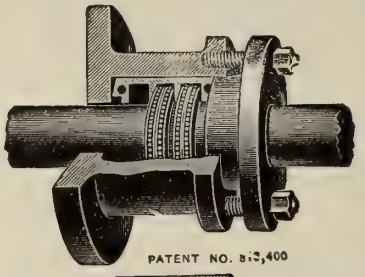

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Lasts many times longer. 30 days trial. Less oil. No cutting. Easily applied to any Steam Engine, Air Compressor or Gas Engine. Satisfaction or no pay. Write us.

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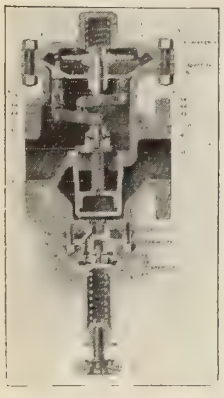

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Sold on 30 days' trial—Your dealer can supply you promptly.

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Everyone operating a Stationary Steam Plant of 50 h.p. or over, in the Province of Ontario, must hold a Certificate from this Board. Anyone operating such a plant without a Certificate is liable to the penalties set forth in the Stationary Engineers' Act

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Mueller Pressure Reducing and Regulating Valves

Give accurate and absolute control of pressures of water, steam, air, gas, oil, carbonic and acetylene gases—in fact, all kinds of pressures. Their efficiency is firmly established. Manufactured under Canadian patent No. 127,566. Address:

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LANCO BALATA
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Federal Engineering Company Limited

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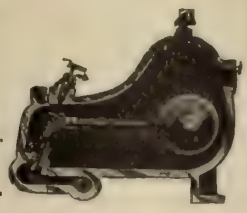
FOR HIGH OR LOW PRESSURE.

Steam can't blow through. They have large discharge valves and cannot be flooded from sudden flushes of water.

MAY WE SEND ONE FOR TRIAL?

Reducing Valves, Pump Governors, Relief Valves, Exhaust Pipe Heads, Ejectors and Steam Separators. SEND FOR CATALOGUE.



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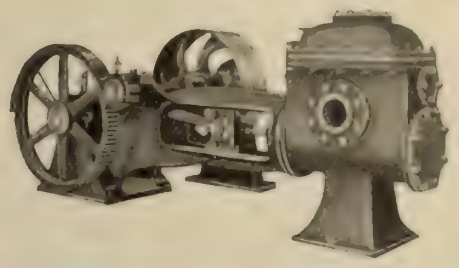

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THE ART METROPOLE
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ARTISTS AND DRAUGHTSMENS MATERIALS

Faber's No. 368, Slide Rule, specially graduated for Electrical Computations.

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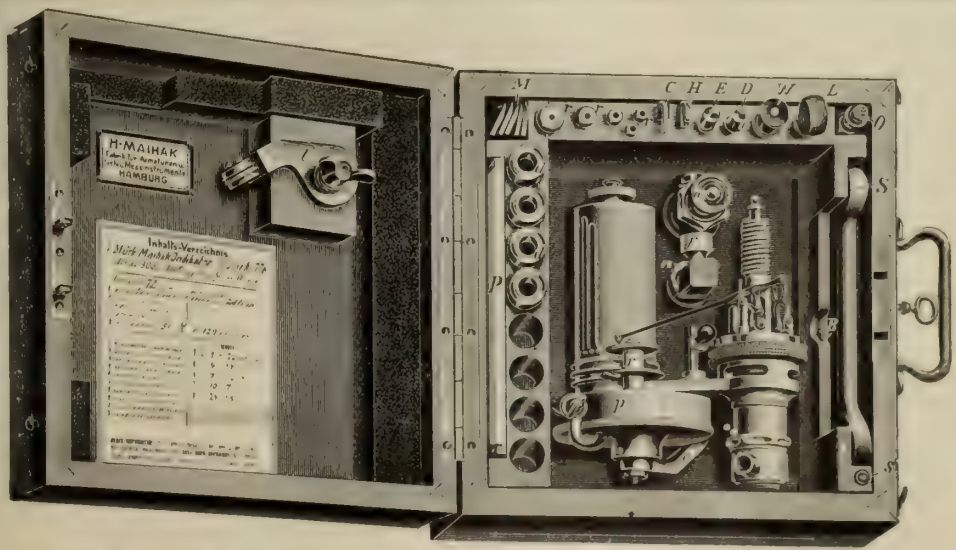

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of the Maihak Indicator, Tachometers, Tachographs, Stroke Counters, Revolution Counters and

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This indicator made in Germany is the best in the world.

Outside spring, and easily exchanged.

Indicator Specialties; Locomotive Indicators with Electrical Attachment; Bottcher's Efficiency Reckoners; Spring Testing Plants.

What is Detector Phone?

Write for Description.

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BEATH CRANES CHAIN BLOCKS TROLLEYS OVERHEAD RUNWAYS

Solve Coal, Machinery and Merchandise Handling Problems.
Hand, Pneumatic and Electrically Operated.

Tell us what you wish to do, and we'll suggest the proper equipment for you.

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SOLD ON MERIT

They are designed to meet modern machinery conditions.

We want you to know the following of our Brands:

PRICHARD'S EAGLE GENUINE
PRICHARD'S MACHINERY SPECIAL
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They represent the best that can be made, for **High Speed, Heavy Pressure,** or **General Purpose** use.

Our Babbitt's are guaranteed to make good, or **No Charge.** Our goods are also guaranteed to be fully up to standard, and our prices, which you will find very reasonable, quality considered, are named for goods F.O.B. your station. Let us tell you about our goods.

It will pay you to send in a trial order.

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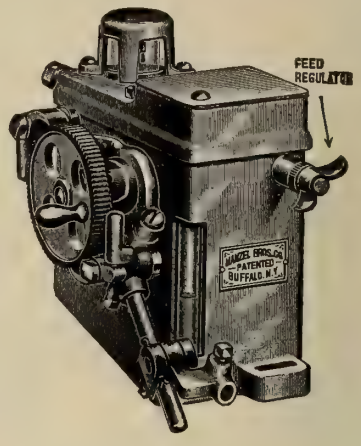
AUTOMATIC FORCE AND SIGHT FEED **Oil Pump**

gives positive lubrication, and feeds regularly, regardless of steam pressure, temperature, speed of engine, or any kind of oil used.

Saves 50 per cent. in oil over that of any Hydiostatic Lubricator.

We will send the Manzel Oil Pump to you on a THIRTY DAYS' TRIAL. If it does not save 50 per cent. of your oil return it at our expense.

WRITE FOR IT NOW.



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IN counting the revolutions of engines, turbines, motors, line shafting or the revolving parts of any machine, there is nothing equal to the

STARRETT SPEED INDICATOR

Made in Three Styles to suit various needs. No. 104 costs only $1.00. Send for Catalogue 19 CD.

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Machine Banded Wood Stave

WATERPIPES and TANKS

For city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

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Full Particulars and Estimates Furnished

Detroit Lubricators for every engine

Detroit Lubricators are made in styles and sizes for every kind of steam engine, pump, gas and gasoline engine or other machines of any kind.

The big 232-page Detroit catalog shows sight feed lubricators mechanical force feed oilers, hand pumps, glass oil cups, brass oilers, grease cups, air cocks, priming cups, water gauges and other boiler trimmings, a complete line of radiator valves and a multitude of other devices.

It gives instructions for all lubricators, and contains valuable information on the general subject of lubrication.

Detroit products are standard the world over. The first lubricator ever sold was manufactured by the Detroit Lubricator Company, and the reputation acquired as originators has been maintained by meeting at once every requirement in the entire field of lubrication, and by producing devices unequalled for efficiency, economy, durability, workmanship and quality of material. Over 1,250,000 Detroit Lubricators are in use to-day.

Write to-day for catalog G-58 and full information.

CANADIAN DETROIT LUBRICATOR COMPANY, LTD.
WALKERVILLE, ONTARIO
Largest manufacturers of lubricating device in the world.

The Morehead Condenser Trap makes its own Vacuum

and PULLS the accumulated water and air out of your steam lines, insuring rapid circulation. Enables you to cut down your boiler pressure on direct heating systems.

Particularly adapted for use in connection with reduced pressure and Exhaust Steam Heating Systems, Dry Kilns, Dryers, Fan Stacks, Etc.

Write for Particulars and a Trial Trap.

Canadian Morehead Mfg. Co.
WOODSTOCK, ONT.

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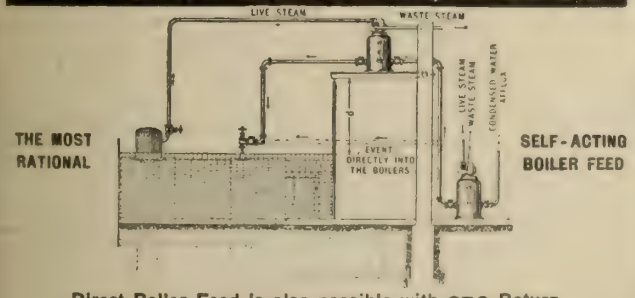

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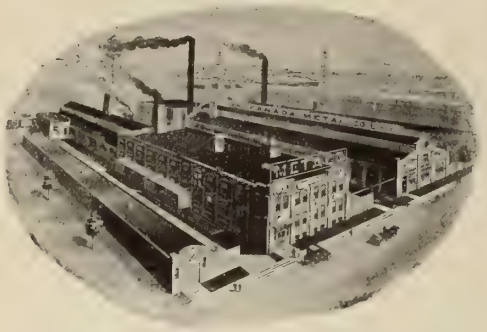

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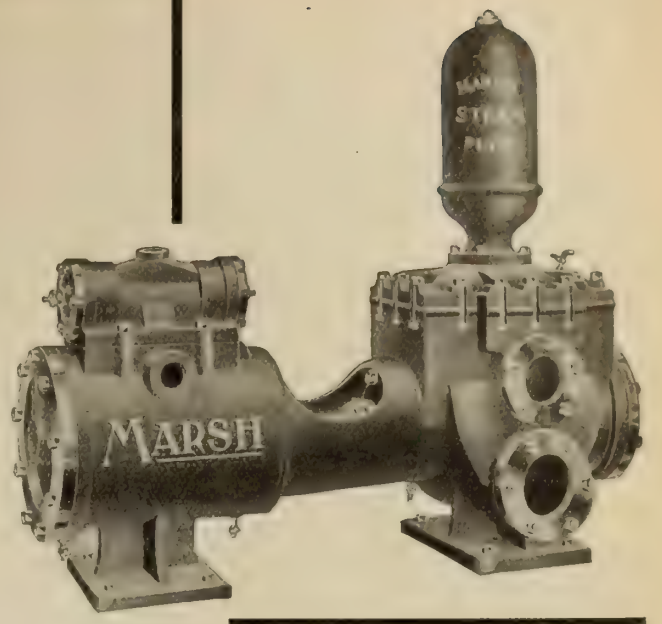

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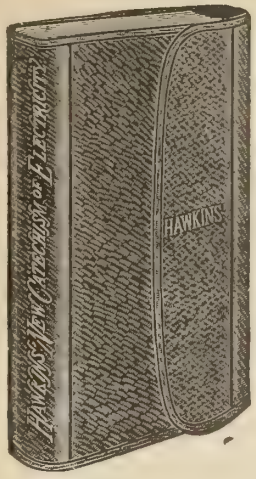

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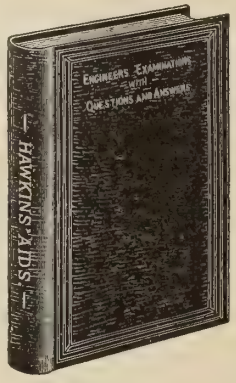

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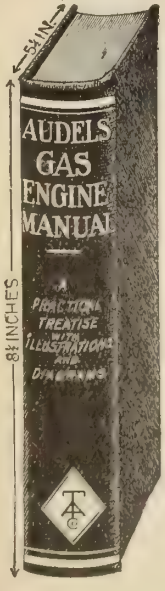

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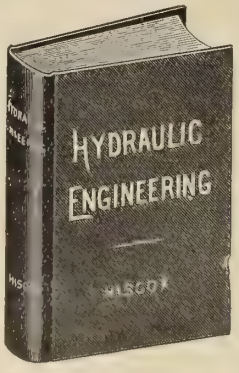

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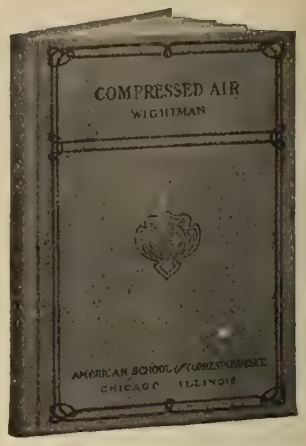

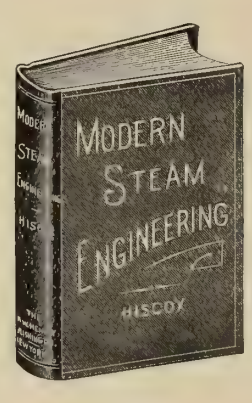

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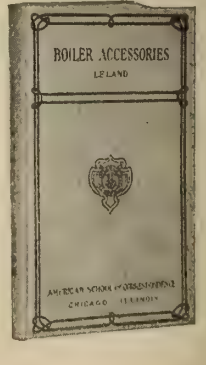

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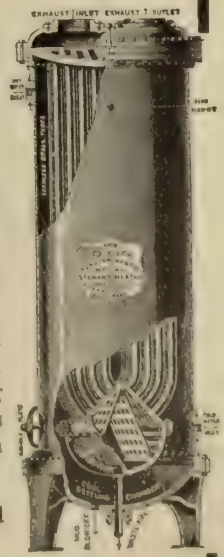

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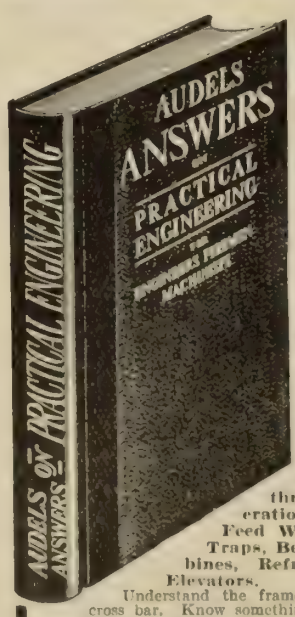

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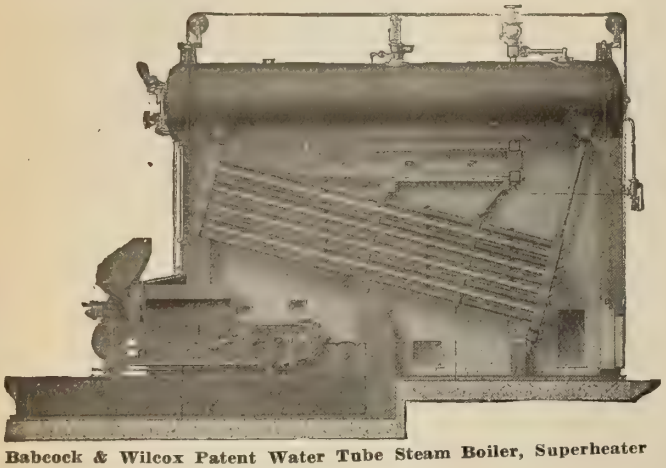

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Bayfield & Archibald, Vancouver, B.C
Chas. Bishop, M.I.C.S.A., Montreal.
de Gaspe Beaubien, Montreal.
John T. Farmer, Montreal.
Fetherstonhaugh & Co., Montreal.
Walter J. Francis, Montreal.
Jacobs & Davies, Inc., Montreal.
Pratt & Ross, Toronto.
J. M. Robertson, Montreal.
J. M. Shanly, Montreal.
Surveyor & Frigon, Montreal.
A. V. Tracy-Gould, Montreal.

Contractors, Structural Steel.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Canada Fdry. Co., Ltd., Toronto.

Conveyor Machinery.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Engineering Works of Canada, Ltd., Montreal.
Jeffrey Manufacturing Co., Columbus.
Waterous Engine Wks. Co., Brantford

Cooler Doors.
Jones Cold Store Door Co., Hagerstown, Md.

Cork Insulation.
Can. H. W. Johns-Manville Co., Toronto.

Cotton Hose.
Garlock Packing Co., Hamilton, Ont.
Quaker City Rubber Co., Philadelphia.

Couplings.
Can. Bond Hanger & Coupling Co., Alexandria, Ont.
Canadian Boving Co., Toronto.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Elmira Machinery and Transmission Co., Elmira.
Jeffrey Manufacturing Co., Columbus.

Cranes, Electric.
Babcock & Wilcox, Montreal.
Canada Fdry Co., Ltd., Toronto.
Smart-Turner Machine Co., Ltd., Hamilton.

Crank and Crosshead Pin Oilers
Lunkenheimer Co., Cincinnati, O.

Crushing Machinery.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundry Co., Ltd., Toronto.

Damper Regulators.
Darling Bros., Montreal.
G. M. Davis Regulator Co., Chicago, Ill.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
Jas. Morrison Brass Mfg. Co., Toronto.

Detector Phones.
The Maihak Indicator Agency, Montreal.

Doors, Cold Storage and Freezer.
Jones Cold Store Door Co., Hagerstown, Md.

Dry Cleaners Systems.
S. F. Bowser & Co., Inc., Toronto.

Drying Machinery.
Can. Fairbanks-Morse Co., Montreal.

Dynamos.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.
Siemens Co. of Canada, Ltd. Montreal.

Economizers.
Babcock & Wilcox, Montreal.
Can. Fairbanks-Morse Co., Montreal.

Ejectors.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
Smart-Turner Machine Co., Ltd., Hamilton.

Electric Fans.
Canadian General Electric Co., Ltd., Toronto.
Siemens Co. of Canada, Ltd. Montreal.

Electrical Accessories and Machinery.
Can. Fairbanks-Morse Co., Montreal.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Canadian H. W. Johns-Manville Co., Toronto.
Engineering Works of Canada, Ltd., Montreal.
Monarch Electric Co., St. Lambert, Que.
Northern Electric & Mfg. Co., Limited Montreal.

Electrical Repairs.
Siemens Co. of Canada, Ltd. Montreal.

Elevators.
Engineering Works of Canada, Ltd., Montreal.
John McDougall Caledonian Iron Wks, Montreal.

Elevating Machinery.
Can. Fairbanks-Morse Co., Montreal.
Engineering Works of Canada, Ltd., Montreal.
Goldie & McCulloch Co., Galt.
Jeffrey Manufacturing Co., Columbus.
Waterous Engine Works Co., Brantford.

Engineers' Supplies.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.

Engines, Automatic and Drop Valve.
E. Leonard & Sons, London, Ont.
International Engineering Works, Ltd., Amherst, N. S.
Waterous Engine Works Co., Brantford.

Engines, Corliss and Rocking Valve.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que
E. Leonard & Sons, London, Ont.
International Engineering Works, Ltd., Amherst, N. S.
Waterous Engine Works Co., Brantford.

Engines, Gas and Gasoline.
Canada Foundry Co., Ltd., Toronto.
Canadian Boving Co., Toronto
Canadian Westinghouse Co., Hamilton.
E. Leonard & Sons, London, Ont.
John Robson (Shipley) Ltd., Shipley, Eng.
Smart-Turner Machine Co., Ltd., Hamilton.

Engines, High Speed, Steam.
Canadian Boving Co., Toronto.
Engineering Works of Canada, Ltd., Montreal.
Goldie & McCulloch Co., Galt.
Laurie & Lamb, Montreal.
E. Leonard & Sons, London, Ont.
John McDougall Caledonian Iron Wks, Montreal.
International Engineering Works, Ltd., Amherst, N. S.
Waterous Engine Works Co., Brantford.

Engines, Marine.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
E. Leonard & Sons, London, Ont.
Laurie & Lamb, Montreal.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.

Engines, Saw Mill.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que
Laurie & Lamb, Montreal.
E. Leonard & Sons, London, Ont.
International Engineering Works, Ltd., Amherst, N. S.
Waterous Engine Works Co., Brantford.

Engines, Single, Compound and Triple Expansion.
Canadian Boving Co., Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Laurie & Lamb, Montreal.
E. Leonard & Sons, London, Ont.
John McDougall Caledonian Iron Wks, Montreal.
Kerr Engine Co., Walkerville.
International Engineering Works, Ltd., Amherst, N. S.
Waterous Engine Works Co., Brantford.

Engines, Vertical.
Laurie & Lamb, Montreal.
E. Leonard & Sons, London, Ont.
International Engineering Works, Ltd., Amherst, N. S.

Engineers' Supplies.
Lunkenheimer Co., Cincinnati, O.

Exhaust Fans.
W. H. Allen Son & Co. Bedford, Eng.
Hare Eng. Co., Toronto.

Exhaust Heads.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
Jas. Morrison Brass Mfg. Co., Toronto.
The Sims Co., Erie, Pa.
Steam Appliance Co., Milwaukee, Wis.
Watson & McDaniel Co., Philadelphia

Expansion Joints.
Lunkenheimer Co., Cincinnati, O.

Feed Water Alarms.
H. L. Peiler & Co., Montreal.

Feed Water Analyser.
C. C. Snowdon, Calgary.

Feed Water Heaters.
Alberger Condenser Co., New York.
Babcock & Wilcox, Montreal.
Can. Fairbanks-Morse Co., Montreal.
Canada Foundry Co., Ltd., Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
National Pipe Bending Co., New Haven, Conn.
International Engineering Works, Ltd., Amherst, N. S.
The Sims Co., Erie, Pa.
Waterous Engine Works Co., Brantford.

Feed Water Regulators.
Canada Foundry Co., Ltd., Toronto.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
Ronald Trist & Co., London, Eng.

Filters.
John McDougall Caledonian Iron Wks, Montreal.

Fire Hose.
Quaker City Rubber Co., Philadelphia, Pa.
Reddaway & Co., F., Montreal.

Fireproof Cold Store Doors and Windows.
Jones Cold Store Door Co., Hagerstown, Md.

Flanges.
Dart Union Co., Toronto.
Lunkenheimer Co., Cincinnati, O.

Flue Brushes.
Steam Appliance Co., Milwaukee, Wis.

Flumes, Steel.
Canada Foundry Co., Ltd., Toronto.
Canadian Boving Co., Toronto.
E. Leonard & Sons, London, Ont.

Freezer Doors.
Jones Cold Store Door Co., Hagerstown, Md.

Insulators.
Ed. Bemis & Co., Bolton, Eng.
Geo. H. Tod, Toronto.

Furnace Linings.
Hare Eng. Co., Toronto.

Fuses.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.
Canadian General Electric Co., Ltd., Toronto.

Gaskets, Rubber, Asbestos and Copper.
Goetze-Gasket & Packing Co., New Brunswick.
Canadian H. W. Johns-Manville Co. Ltd., Toronto.
Garlock Packing Co., Hamilton, Ont.

Gas Exhausters.
Hare Eng. Co., Toronto.

Gas Producer Plants.
Canadian Boving Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Canada Foundry Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
E. Leonard & Sons, London, Ont.

Gasolene & Oil Storage & Distributing Systems.
S. F. Bowser & Co., Inc., Toronto.

Gauge Cocks.
Can. Fairbanks-Morse Co., Montreal.
Hare Eng. Co., Toronto.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
Ohio Brass Co., Mansfield, Ohio.
W. J. Wall, Montreal.
Garlock Packing Co., Hamilton, Ont.
Lunkenheimer Co., Cincinnati, O.

Gauges—Pressure, Vacuum, Draft and Recording.
Babcock & Wilcox, Montreal.
Lunkenheimer Co., Cincinnati, O.

Gauges, Water.
Jenkins Bros., Ltd., Montreal.
The Lunkenheimer Co., Cincinnati, O.
Ohio Brass Co., Mansfield, Ohio.

Gears, Cut, Worm, Mortise.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.

Generators.
Siemens Co. of Canada, Ltd. Montreal.
Can. Fairbanks-Morse Co., Montreal.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.
Northern Electric & Mfg. Co., Limited, Montreal.

Graphite, Boiler.
Jos. Dixon Crucible Co., Jersey City.
Federal Graphite Mills, Cleveland.
C. C. Snowdon, Calgary.

Graphitol.
British Pacific Supply Co., Victoria, B.C.

Grates.
Babcock & Wilcox, Montreal
Ed. Bemis & Co., Bolton, Eng.
Boiler Repair & Grate Bar Co., Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Hare Eng. Co., Toronto.
Geo. H. Tod, Toronto.

Grease Cups.
Detroit Lubricator Co., Walkerville.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
Peterborough Machine & Lubricator Co., Ltd., Peterborough.

Grease and Oil Extractors.
Canada Foundry Co., Ltd., Toronto.
Elliott Co., Pittsburgh, Pa.
C. C. Snowdon, Calgary.
Hare Eng. Co., Toronto.
Steam Appliance Co., Milwaukee, Wis.

Greases.
Adams Cooks Son, New York.
Albany Lubricating Co., New York.
British Pacific Supply Co., Victoria, B. C.
Can. Fairbanks-Morse Co., Montreal.
Can. Oil Companies, Ltd., Toronto.
Jos. Dixon Crucible Co., Jersey City.
C. C. Snowdon, Calgary.

Hangers.
Can. Bond Hanger & Coupling Co., Alexandria.
Can. Fairbanks-Morse Co., Montreal.
Elmira Machinery and Transmission Co., Elmira.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

Heaters.
Canada Foundry Co., Toronto.
Darling Bros., Montreal.
Goldie & McCulloch Co., Galt.
Hare Eng. Co., Toronto.
E. Leonard & Sons, London, Ont.
The Sims Co., Erie, Pa.

Hoists.
Engineering Works of Canada, Ltd., Montreal.

Hose, Steam, Suction and Water.
Garlock Packing Co., Hamilton, Ont.

Hydraulic Accumulators.
Canada Foundry Co., Ltd., Toronto.
Smart - Turner Machine Co., Ltd., Hamilton.

Hydraulic Machinery.
Engineering Works of Canada, Ltd., Montreal.
John McDougall Caledonian Iron Wks, Montreal.

Hydraulic Presses.
Bawden Machine Co., Toronto.

Ice Making Machinery.
Linde British Refrigeration Co., Montreal.
York Mfg. Co., York, Pa.

Indicators, Electric—All Types.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton

Indicators, Steam and Gas Engine.
Can. Fairbanks-Morse Co., Montreal.
The Maihak Indicator Agy., Montreal.

Indicators—Ammonia, Hydraulic.
Detroit Lubricator Co., Walkerville.

Indicating.
Renown Engine & Machine Co., Montreal.

Injectors.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
Penberthy Injector Co., Windsor.

Furnaces.
Monarch Electric Co., St. Lambert, Que.

Iron Filler.
Imperial Waste & Metal Co., Montreal.

Lamps, Tungsten, etc.
Canadian General Electric Co., Ltd., Toronto.

Lamps, Arc, Incandescent.
Canadian General Electric Co., Ltd., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Canadian Westinghouse Co., Hamilton
P. H. Klein, Jr., Co., Montreal.
Northern Electric & Mfg. Co., Limited, Montreal.

Lubricants.
British Pacific Supply Co., Victoria.
Can. Oil Companies, Ltd., Toronto.
Jos. Dixon Crucible Co., Jersey City.
C. C. Snowdon, Calgary.

Lubricators, Force Feed.
Darling Bros., Montreal.
Can. Detroit Lubricator Co., Windsor,
Lunkenheimer Co., Cincinnati, O.
Manzel Bros. Co., Buffalo, N.Y.
Peterborough Machine & Lubricator Co., Ltd., Peterborough.

Lubricators, Plain.
Can. Detroit Lubricator Co., Windsor, Ont.
Lunkenheimer Co., Cincinnati, O.

Mechanical Stokers.
Babcock & Wilcox, Montreal.
Ed. Bemis & Co., Bolton, Eng.
Fraser & Chalmers, Ltd., Montreal.
Hare Eng. Co., Toronto.
Jones Underfeed Stoker Co., Toronto.
Murphy Iron Works, Detroit, Mich.
Geo. H. Tod, Toronto.

Meters, Electric.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Monarch Electric Co., St. Lambert, Que.
Siemens Co. of Canada, Ltd. Montreal.

Meters, Water.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Siemens Co. of Canada, Ltd. Montreal.

Mica.
Kent Brothers, Kingston, Ont.

Mill Supplies.
Andrews & Son, F. H., Quebec.
Reddaway & Co., F., Montreal.

Mill and Mining Machinery.
Can. Fairbanks-Morse Co., Montreal.
Engineering Works of Canada, Ltd., Montreal.
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co. Sherbrooke, Que
International Engineering Works, Ltd., Amherst, N. S.
Waterous Engine Works Co., Brantford.

Molds, Rubber.
Bawden Machine Co., Toronto.

Motors.
Can. Fairbanks-Morse Co., Montreal.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.
Northern Electric & Mfg. Co., Limited, Montreal.
Siemens Co. of Canada, Ltd. Montreal.

Motor Starters and Controllers.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.
Siemens Co. of Canada, Ltd. Montreal.

Office Railings.
Jas. Morrison Brass Mfg. Co., Toronto.

Oil Cups.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.

Oiler Compound Feeders.
Lunkenheimer Co., Cincinnati, O.

Oilers, Gauge.
Lunkenheimer Co., Cincinnati, O.

Oilers, Multiple.
Can. Detroit Lubricator Co., Windsor,
Lunkenheimer Co., Cincinnati, O.

Oil Filters & Circulating Systems.
S. F. Bowser & Co., Inc., Toronto.
Darling Bros., Montreal.
Elliott Co., Pittsburgh, Pa.
Jas. Morrison Brass Mfg. Co., Toronto.
The Sims Co., Erie, Pa.

Oil Separators, Ammonia.
Steam Appliance Co., Milwaukee,

Oil Separators.
Babcock & Wilcox, Montreal.
Can. Fairbanks-Morse Co., Montreal.
Canada Foundry Co., Ltd., Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
C. A. Dunham Co., Toronto.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
Liberty Mfg. Co., Pittsburg.
Jas. Morrison Brass Mfg. Co., Toronto.
Smart - Turner Machine Co., Ltd., Hamilton.
Steam Appliance Co., Milwaukee

Oiling Systems.
S. F. Bowser & Co., Inc., Toronto.

Oils, Lubricating.
British Pacific Supply Co., Victoria
Can. Oil Companies, Ltd., Toronto.
Dearborn Chemical Co., Chicago.
C. C. Snowdon, Calgary.

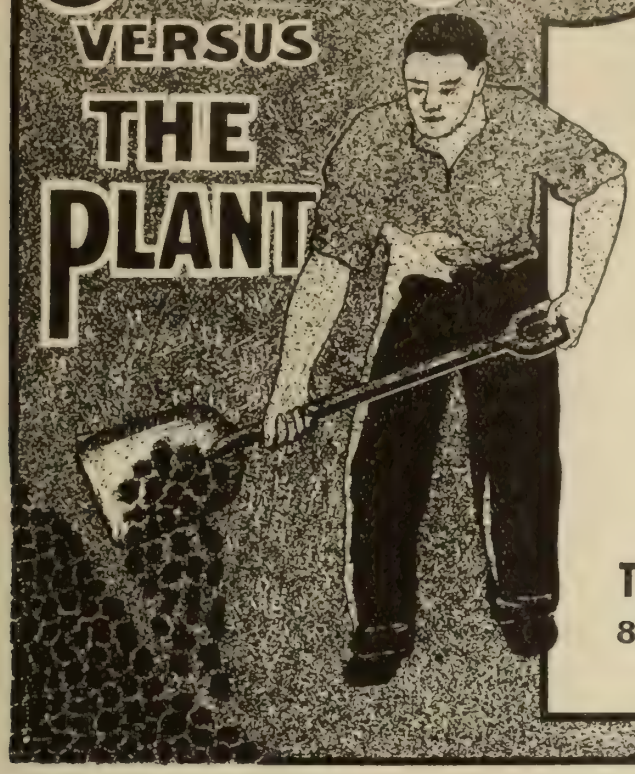
Packing Engine.
Can. H. W. Johns-Manville Co., Toronto.
Dunlop Tire & Rubber Goods Co., Toronto.
Garlock Packing Co., Hamilton, Ont.
Steel Mill Packing Co., Windsor, Ont.

Packing, Metallic.
Holmes Metallic Packing Co., Wilkesbarre, Pa.
Quaker City Rubber Co., Philadelphia, Pa.
Steel Mill Packing Co., Windsor, Ont.

Packing, Rod.
Goetze-Gasket & Packing Co., New Brunswick, N.J.
Canadian H. W. Johns-Manville Co. Ltd., Toronto.
Garlock Packing Co., Hamilton, Can.
Steel Mill Packing Co., Windsor, Ont

Packing, Sheet.
Garlock Packing Co., Hamilton, Can.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.
Jenkins Bros., Ltd., Montreal.
Quaker City Rubber Co., Philadelphia, Pa.

STEAM COALS VERSUS THE PLANT



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Canadian H. W. Johns-Mansville Co., Toronto.
Garlock Packing Co., Hamilton, Can.
Quaker City Rubber Co., Philadelphia, Pa.
Steel Mill Packing Co., Windsor, Ont.

Packing, Rubber.
Dunlop Tire and Rubber Goods Co., Toronto.

Patents.
Rowland Brittain, Vancouver, B.C.

Penstocks.
Canada Foundry Co., Ltd., Toronto.
Canadian Boving Co., Toronto.

Penstock Lugs.
Otterville Mfg. Co., Otterville, Ont.

Pillow Blocks.
Can. Bond Hanger & Coupling Co., Alexandria.
Elmira Machinery & Transmission Co., Elmira, Ont.

Pipe Coils.
National Pipe Bending Co., New Haven, Conn.
York Mfg. Co., York, Pa.

Pipe Cutting and Treading Machine and Tools.
Can. Fairbanks-Morse Co., Montreal.

Pipe, Steel.
Canada Foundry Co., Ltd., Toronto.
Canadian Boving Co,. Toronto.
E. Leonard & Sons, London, Ont.

Pipe (Second-Hand).
Imperial Waste & Metal Co., Montreal.

Pipes, Water.
Canada Foundry Co., Ltd., Toronto.
Canadian Boving Co., Toronto.
Pacific Coast Pipe Co., Vancouver, B. C.

Piping and Fittings.
Jas. Morrison Brass Mfg. Co., Toronto.
York Mfg. Co., York, Pa.

Piping, Steam.
Babcock & Wilcox, Montreal.
Imperial Waste & Metal Co., Montreal.

Plate Work.
Canada Foundry Co., Ltd., Toronto.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

Polish, Metal.
G. W. Hoffman, Indianapolis.

Power Pumps.
American Steam Pump Co., Battle Creek, Mich.
Canadian Boving Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Canada Foundry Co., Ltd., Toronto.
Darling Bros., Montreal.
Goldie & McCulloch Co., Galt.
Goulds Pump Co., Montreal.
E. Leonard & Sons, London, Ont.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.
Waterous Engine Works Co., Brantford.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.
Garlock Packing Co., Hamilton, Can.

Power Transmission Machinery.
Can. Bond Hanger & Coupling Co., Alexandria, Ont.
Can. Fairbanks-Morse Co., Montreal.
Elmira Machinery & Transmission Co., Elmira, Ont.
Engineering Works of Canada, Ltd., Montreal.
Goldie & McCulloch Co., Galt.
Jeffrey Manufacturing Co., Columbus.
Jenckes Machine Co., Sherbrooke, Que.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Waterous Engine Works Co., Brantford.
Siemens Co. of Canada, Ltd. Montreal.

Pulleys.
Can. Fairbanks-Morse Co., Montreal.
Elmira Machinery and Transmission Co., Elmira, Ont.
Jeffrey Manufacturing Co., Columbus.
Waterous Engine Works Co., Brantford.

Pulp Mill Machinery.
The Bawden Machine Co., Toronto.
Escher, Wyss & Co., Toronto.
Jeffrey Manufacturing Co., Columbus.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford.

Pumping Machinery.
American Steam Pump Co., Battle Creek, Mich.
Canadian Boving Co., Toronto.
Canada Fdry Co., Ltd., Toronto.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.
Standard Eng. Co., Toronto.
Waterous Engine Works Co., Brantford.

Pumping Machinery, Electrical.
Jeffrey Manufacturing Co., Columbus.

Pump Governors and Regulators.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
C. A. Dunham Co., Toronto.
G. M. Davis Regulator Co., Chicago. Ill.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
Smart - Turner Machine Co., Ltd., Hamilton.
Watson & McDaniel Co., Philadelphia.

Pump Strainers.
Canadian Steam Boiler Equipment Co., Toronto.
Liberty Mfg. Co., Pittsburgh, Pa.

Pumps, Air.
American Steam Pump Co., Battle Creek, Mich.
Canadian Boving Co., Toronto.
Canada Foundry Co., Ltd., Toronto.
Can. Fairbanks-Morse Co., Montreal.
E. Leonard & Sons, London. Ont.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.

Pumps, Hand and Power.
S. F. Bowser & Co., Inc., Toronto.

Pumps, Centrifugal.
Canada Foundry Co., Ltd., Toronto.
Canadian Boving Co., Toronto.
Engineering Works of Canada, Ltd., Montreal.
Canadian Boving Co., Toronto.
Escher, Wyss & Co., Toronto.
Hare Eng. Co., Toronto.
E. Leonard & Sons, London, Ont.
John McDougall Caledonian Iron Wks. Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.
Waterous Engine Works Co., Brantford.

Pumps, Geared, Compound.
American Steam Pump Co., Battle Creek, Mich.
The Bawden Machine Co., Toronto.
Canada Foundry Co., Ltd., Toronto.
Can. Fairbanks-Morse Co., Montreal.
E. Leonard & Sons, London, Ont.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.

Pumps, Hydraulic, Pressure.
American Steam Pump Co., Battle Creek, Mich.
Canada Foundry Co., Ltd., Toronto.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.

Pumps, Oil.
The Bawden Machine Co., Toronto.
S. F. Bowser & Co., Inc., Toronto.
Can. Detroit Lubricator Co., Walkerville, Ont.
Lunkenheimer Co., Cincinnati, O.
Manzel Cros. Co., Buffalo, N.Y.
Smart - Turner Machine Co., Ltd., Hamilton.

Pumps, Steam.
American Steam Pump Co., Battle Creek, Mich.
Bawden Machine Co., Toronto.
S. F. Bowser & Co., Inc., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Canada Foundry Co., Ltd., Toronto.
Darling Bros., Montreal.
C. A. Dunham Co., Toronto.
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.

Pumps, Vacuum.
American Steam Pump Co., Battle Creek, Mich.
The Bawden Machine Co., Toronto.
Canadian Boving Co., Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Hare Eng. Co., Toronto.
C. A. Dunham Co., Toronto.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.

Pump Tank, Receiver.
American Steam Pump Co., Battle Creek, Mich.
Canada Fdry. Co.. Ltd.. Toronto.

Pyrometers.
Jas. Morrison Brass Mfg. Co., Toronto.

Rails (Relaying).
Imperial Waste & Metal Co., Montreal

Radiator Air Vents.
Jas. Morrison Brass Mfg. Co., Toronto.

Refrigerator Doors, Windows, Etc.
Jones Cold Store Door Co., Hagerstown, Ind.

Refrigerating Engineers.
Arctic Ice Making Co., Canton, O.
Chas. Bishop, Montreal.

Refrigerating Machinery.
Linde British Refrigeration Co., Montreal.
Linde Can. Refrigeration Co., Montreal.
Vilter Mfg. Co., Milwaukee, Wis.
York Mfg. Co., York, Pa.

Regulators, Pressure.
C. A. Dunham Co., Toronto.
Jas. Morrison Brass Mfg. Co., Toronto.
Ohio Brass Co., Mansfield, Ohio.
The Sims Co., Erie, Pa.

Revolving Doors for Hardening Rooms.
Jones Cold Store Door Co., Hagerstown, Md.

Revolution Counters.
Maihak Indicator Agency, Montreal.

Rheostats.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co. Hamilton.
Siemens Co. of Canada, Ltd. Montreal.

Roofings—Asbestos and Wool Felts
Canadian H. W. Johns-Manville Co., Ltd., Toronto.

Rope Preservative.
Cling Surface Co., Buffalo.

Rotary Converters.
Can. Fairbanks-Morse Co., Montreal.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Siemens Co. of Canada, Ltd. Montreal.

Rubber Hose.
Garlock Packing Co., Hamilton, Ont.
Liberty Mfg. Co., Pittsburg, Pa.
Quaker City Rubber Co., Philadelphia.

Rubber Molds.
The Bawden Machine Co., Toronto.

Safes.
Can. Fairbanks-Morse Co., Montreal.
Goldie & McCulloch Co., Galt.

Safety Valves.
Can. Fairbanks-Morse Co., Montreal.
Lunkenheimer Co., Cincinnati, O.

Shafting.
Elmira Machinery and Transmission Co., Elmira.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Wks. Co., Brantford

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Hare Eng. Co., Toronto.
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E. Leonard & Sons, London, Ont.
Waterous Engine Wks. Co., Brantford

Smokeless Furnaces.
Jones Underfeed Stoker Co., Toronto.
Murphy Iron Wks. ,Detroit, Mich.
Geo. H. Tod, Manning Chambers, Toronto.

Soot Cleaners.
Vulcan Tube Cleaning Systems, Ltd., Montreal.

Special Machinery.
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Canada Foundry Co., Ltd., Toronto.
Darling Bros., Montreal.
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The Sims Co., Erie, Pa.
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Steam Appliance Co., Milwaukee.
Watson & McDaniel Co. Philadelphia Montreal.

Steam Specialties.
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Hare Engraving Co., Ltd., Toronto.
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Monarch Electric Co., St. Lambert, Que.
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Tachometers.
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Canada Foundry Co., Ltd., Toronto.
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John McDougall Caledonian Iron Wks. Montreal.

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S. F. Bowser & Co., Inc., Toronto.
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Can. Fairbanks-Morse Co., Montreal.
Elmira Machinery & Transmission Co., Elmira, Ont.
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Jeffrey Manufacturing Co., Columbus.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Waterous Engine Wks. Co. Brantford

Trucks, Factory.
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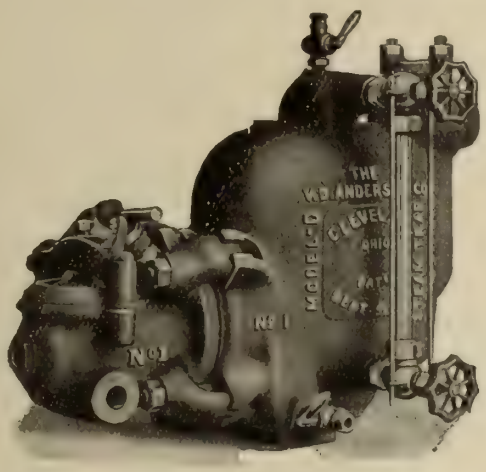
The ANDERSON MODEL "D" STEAM TRAP

is a Steady and Continuous Drainer for Steam Coils, Steam Jackets, Radiators, Etc., and Automatically Adjusts Itself to any Varying Amounts within its Capacity.



The trap is so constructed that you can change the valve and seat from high to low pressure or vice versa in five minutes without disturbing or unscrewing a single joint or pipe connection.

All parts are interchangeable, being machined to solid gauges, thus ensuring absolute accuracy.

A removable perforated strainer is part of the equipment, thus preventing pieces of scale, packing lead, etc., from entering the trap.

Every trap is tested and inspected under boiler pressure by experts before leaving factory. **Every Anderson Model "D" is guaranteed.**

Write for descriptive booklet.

THE V. D. ANDERSON CO.

West 96th St., CLEVELAND, OHIO

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The "SIMS" OIL FILTER

Will Save 65 Per Cent. Of Your Oil.

The oil that passes through the bearings should not be allowed to go to waste—it can be used over again with the best results.

The quality of oil is not impaired by its use. The **"Sims" Oil Filter** removes all impurities that are taken up when the oil passes through the bearings.

The **"Sims" Filter** is made of the best grade of galvanized sheet iron, double-lapped joints, riveted, well braced and soldered. It has a partition through the centre, which separates the clean oil section from that used for filtration.

The clean oil is not disturbed when the filtering section is being cleaned; for continuous oiling systems this arrangement is very effective.

Start saving oil now. Write for full particulars.

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Erie, Pa.

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Liberty Mfg. Co., Pittsburg, Pa.

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Liberty Mfg. Co., Pittsburg, Pa.

Tubes, Boilers.
Babcock & Wilcox, Montreal.

Tube Expanders.
Liberty Mfg. Co., Pittsburg, Pa.

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Can. Tungsten Lamp Co., Hamilton, Ont.
Canadian General Electric Co., Ltd., Toronto.
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Engineering Works of Canada, Ltd., Montreal.
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Hare Eng. Co., Toronto.
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Laurie & Lamb, Montreal.
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Vacuum Regulating Valves.
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Valves.
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Elliott Co., Pittsburgh, Pa.

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Babcock & Wilcox, Montreal.

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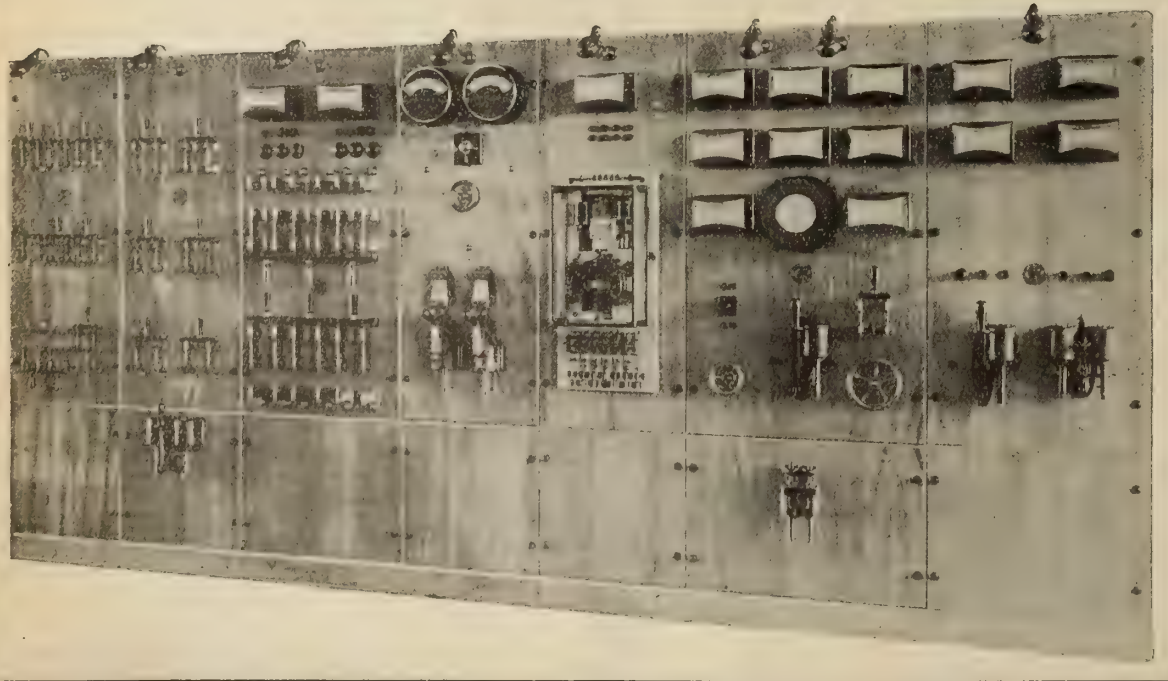

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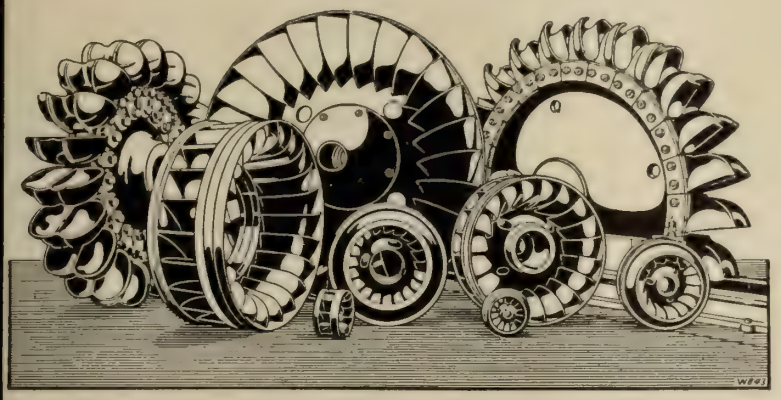

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C. L. Trimingham, 45 Canada Life Bldg. Winnipeg, Man.

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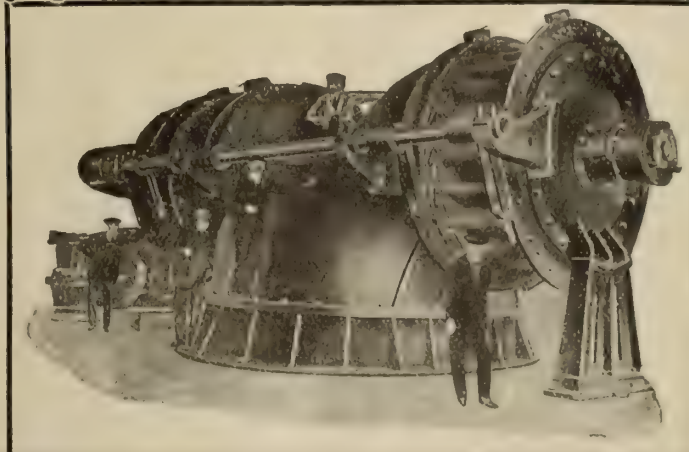
WATER TURBINES
—AND—
GOVERNORS

All Sizes

Maximum Efficiency



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Ideal Control

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THE CANADIAN BOVING CO., LTD.

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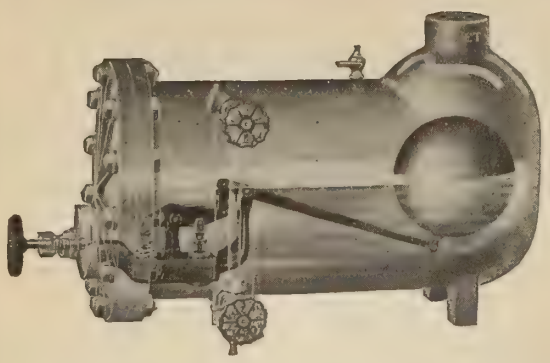

The Davis Improved Steam Trap has renewable Tobin Bronze Valves and Seats

THE Davis is a general service trap. Its purpose is the automatic removal of the water of condensation from steam pipes or any steam receptacle without the loss of steam.

It is not a boiler return trap but will discharge into the atmosphere or against any pressure less than the pressure under which it is being operated.

Having double balanced valves it has an unusually large capacity and may be used under any pressure from 1 to 200 pounds. Its vital parts—the valves and seats—are renewable, and are made of Tobin Bronze, a non-corrosive metal that is practically as hard as steel. This construction adds greatly to its durability and facilitates repairs when they are necessary.

The valves are conical in form with long bevel and are not guided by sleeves. When open they are loose in the seats, hence cannot stick or become clogged with sediment, scale, grease or other foreign matter. All working parts are attached to the cover and removable with it, without breaking either inlet or outlet connections.

Send for 15-page booklet of the Davis Trap and let us quote on the traps you need.

New York
Philadelphia
Boston

G. M. Davis Regulator Co.

Established 1875.

434 Milwaukee Avenue, - CHICAGO

Pittsburgh
St. Louis
San Francisco

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Westinghouse

Low- and High-Pressure Steam Turbines

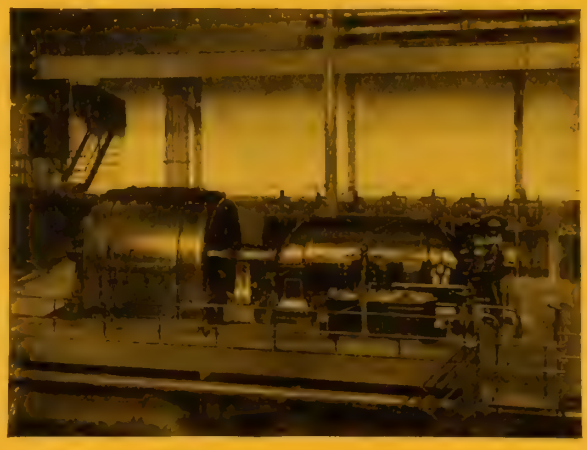
Westinghouse Low-Pressure Turbine

A saving of 79 tons of coal monthly, over previous rates of fuel consumption, was effected in a certain small power station by a 500 kw. Westinghouse Low-Pressure Steam Turbine, using the exhaust steam from a 300 kw. simple Corliss Engine, and a 100 kw. Tandem Compound Automatic Engine.

This 7500 kw. Westinghouse High-Pressure Turbine was installed in a street railway plant in which were several engines, and three large turbines of other make.

We quote from a letter written by the President of the company:

"The computations made by our people show a saving of at least $50.00 per day, for fuel, over the machinery that was installed previous to the purchase of your machine."



Westinghouse High-Pressure Turbine

The important point lies in that this saving was accomplished on the **same station load.** They simply ran the Westinghouse Turbine all the time, and shut down something else.

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Telephone Bldg.

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CALGARY
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Boiler Room Accessories

That are Efficient
Ecomonical and
Dependable

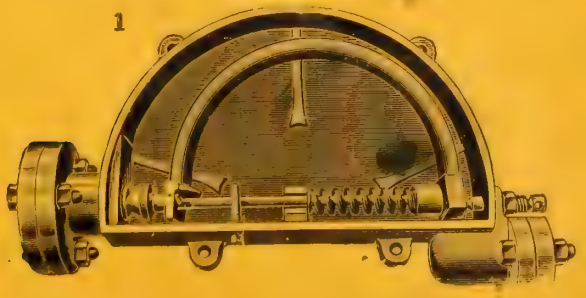
J. M. T. Improved Injector

J. M. T. Pop Safety Valve

Made Flanged and Screwed.

Heintz Steam Trap

A Thermostatic Trap; operates at a variation of one degree of temperature, simplicity in construction, can be placed in any position. The ideal trap for heating coils, and machines operated by steam. They automatically relieve all condensation. Thousands in daily use.



TRADE MARK
J.M.T.
REGISTERED
A GUARANTEE OF QUALITY

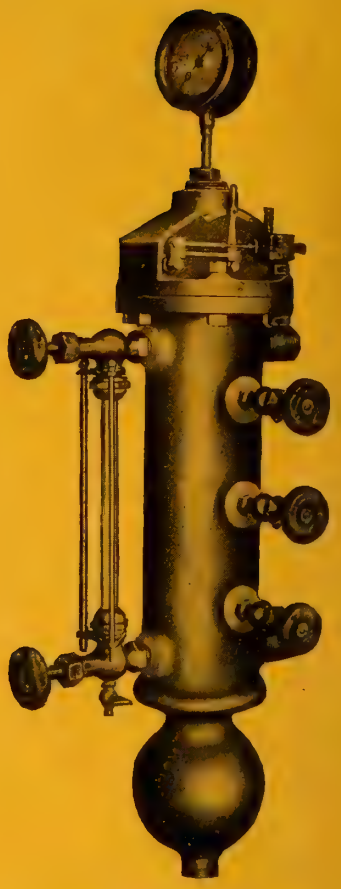
Everything that we sell represents all that is best in quality, design and workmanship, and has a reputation for good service.

We manufacture a large range of **Engineers' Supplies** and **Steam Specialties** in brass and iron.

Let us quote you prices. You'll find them right for that of good quality.

The James Morrison Brass Mfg., Co. Limited

93-97 Adelaide Street West
TORONTO

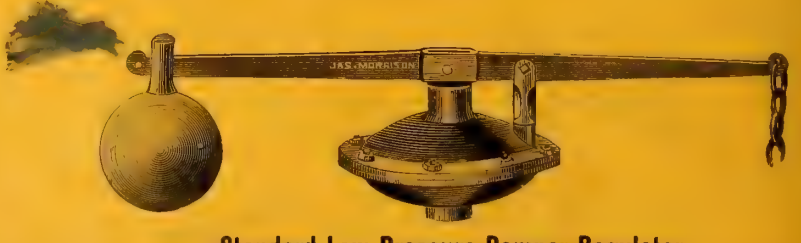


"Reliable" Water Column Complete

With Water Gauge Mountings, Gauge Cocks, and Pressure Gauge.

J. M. T. Valve

Renewable disc made standard and extra heavy pattern, screwed or flanged.



Standard Low Pressure Damper Regulator

Special Feature---C.A.S.E Convention News

THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas Electric, Air and Water Power; and to the operation of Refrigerating Machinery.

Published by The MacLean Publishing Co., Limited.

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Vol. VI Publication Office, Toronto—July, 1913 No. 7

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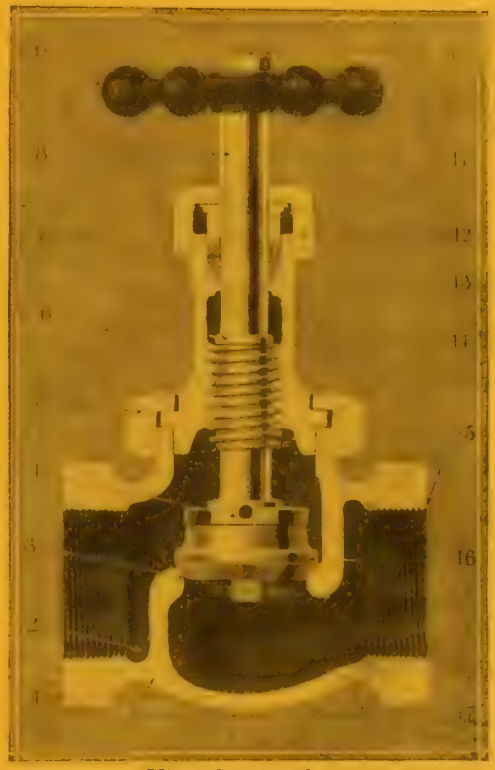
"THE ALL QUALITY LINE"

View Assembled

The Valve YOU Cannot Afford To Do Without

GUARANTEED FOR 200 Lbs. CONTINUOUS PRESSURE



View Sectional

THEY GIVE THE SERVICE

FOR THESE REASONS

SPECIAL QUALITY OF METAL
HEAVY BODY WALL
EXTRA HEAVY HEXAGONS
LIBERAL SEAT THICKNESS
PACKING GLAND FOLLOWER

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BONNET STRONG AND RIGID
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NO DISCS REQUIRED FOR RENEWING. REGRINDING FEATURE ENABLES BOTH THE SEAT OF DISC AND SEAT OF BODY TO BE REGROUND TOGETHER IN ONE OPERATION AT NO EXTRA EXPENSE.

CONVINCE YOURSELVES BY A TRIAL. Send for Booklet "Something Better in Valves." It's free.

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PEERLESS RUBBER MANUFACTURING COMPANY

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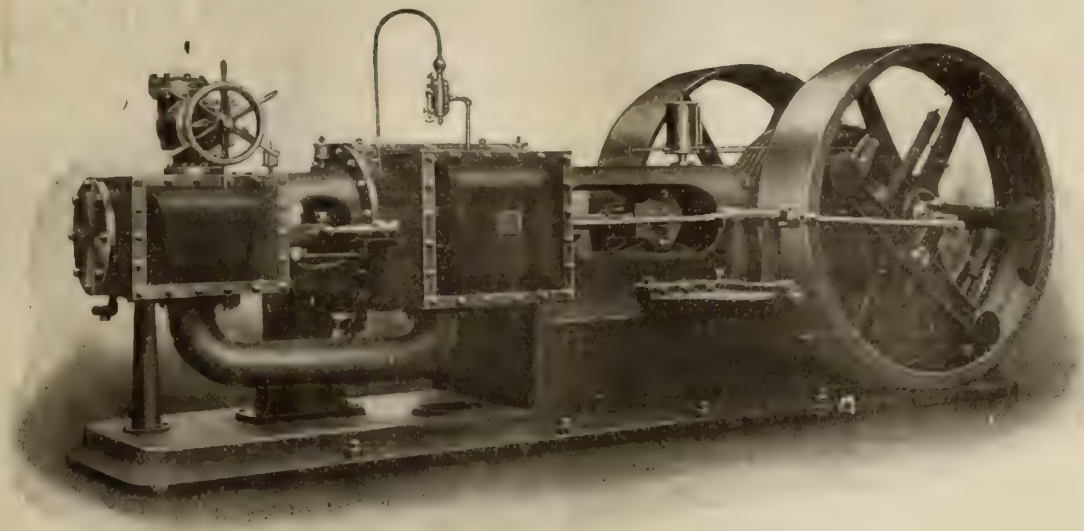
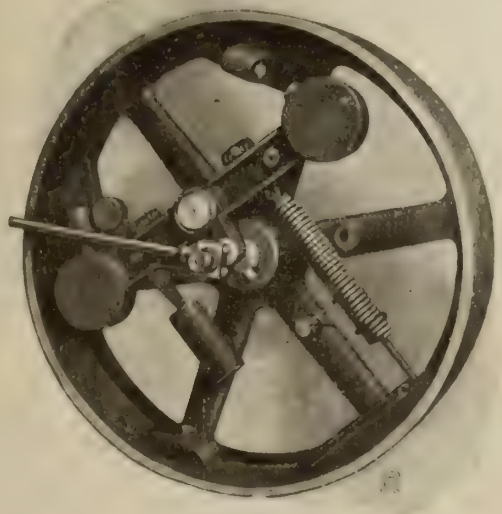
The advertiser would like to know where you saw his advertisement—tell him.

From Full Load To No Load With Less Than 2% Speed Variation



McEWEN ENGINES

One of the foremost sterling features of McEwen Engines is their regulation — just as near perfect as it is possible to make it.



No difficulty is experienced in adjusting McEwen Engines to govern within a limit of one revolution, and the instantaneous variation in speed when the full load is thrown on or off is often less than 2 per cent. This remarkable regulation is due to its quick acting governor, which is unequalled for its refinement of construction and perfection of regulation.

The Bigelow Governor is the pioneer centrifugal inertia governor consisting of "inertia bar" with weights at each end, a third weight cast integral with the "inertia bar", a heavy coil spring and dash pot.

The spring end of the "inertia bar" is heavier and the speed of rotation depends entirely upon the equilibrium between centrifugal force acting on the "inertia bar" and the tension of the spring, while the actual movement of the governor parts is effected by the inertia of the weighted end of the bar. The dash pot prevents racing, and it is possible to adjust the engine so that it will run faster under load than when running light, and still have it regulate perfectly without tendency to race.

No other governor will allow such a close degree of regulation and movement. Strong. Durable. Sensitive. Always ready.

Send for Bulletin.

The Waterous Engine Works Co., Limited

BRANTFORD, CANADA

Mr. Power Plant Owner:

Are you perfectly satisfied with the heating system in your plant?
Do you have to furnish several pounds pressure of steam to force circulation?
Do you suffer expenses from delay, low efficiency and repairs due to freeze-ups?
Do you require the attention of an engineer or other expensive man to doctor various parts of the system in order to get momentary result?
Think it over!

A Dunham Vacuum System Will:-

Insure heat in every radiating unit without loss of steam.

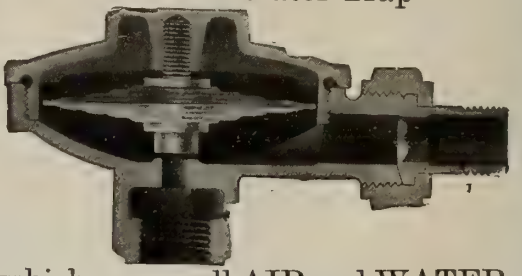
Eliminate all troubles from freeze-ups.

Reduce back pressure on your engine to a minimum (means greater engine economy).

Effects a large saving in your coal bill.

By Use Of

The Dunham Radiator Trap



which passes all AIR and WATER, closes off against STEAM, and proven durable by years of service.

Let us direct you to many satisfied customers who have changed their old unsatisfactory, troublesome system into a Dunham.

Our Engineering Staff is at your disposal

C. A. DUNHAM CO., LTD., Toronto, Can.

Halifax Montreal Vancouver Winnipeg Calgary

Sales Over Five Million Dollars Annually

Four Babbitt Manufacturing Plants

TORONTO LONDON, ENG. NEW YORK ST. LOUIS

Faultless "A" This babbitt is a high grade copper hardened alloy, possessing in a higher degree all the good points of the original Genuine Babbitt, with increased antifriction qualities, having the additional merit of absorbing and holding oil. It is used extensively in France for automobile engines, and in South Africa for mining machinery, and in United States and Canada for marine engines, dynamos and all heavy duty machines. Where heavy service is required this will last longer than any Genuine Babbitt manufactured. For heavy duty, saw mills and engines it is without equal.

Eagle "A" Thousands of tons of this alloy have been placed on the market, giving such perfect results, that it's name and merits are known, we believe, as extensively as any other babbitt manufactured. Its high antifriction and heavy duty qualities make it especially adapted for saw-mills, planing-mills, threshing engines, traction engines, pumps, rolling-mills and general machine shop use.

HOYT METAL COMPANY

TORONTO OFFICE AND MFG. PLANT—EASTERN AVE. AND LEWIS ST.

The advertiser would like to know where you saw his advertisement—tell him.

JENCKES Boilers

HORIZONTAL TUBULAR
VERTICAL TUBULAR

LOCOMOTIVE TYPES
HEATING BOILERS

Give Maximum Service

Jenckes boilers will minimize your stoppage for repairs because they are made of high-grade materials by skilled workmen.

They are made to conform with the various Provincial Inspection Acts, and are rigidly tested under high pressure before leaving the works.

Our modern facilities enable us to furnish Boilers promptly when we do not have them in stock.

We want you to know how these boilers are pleasing others.

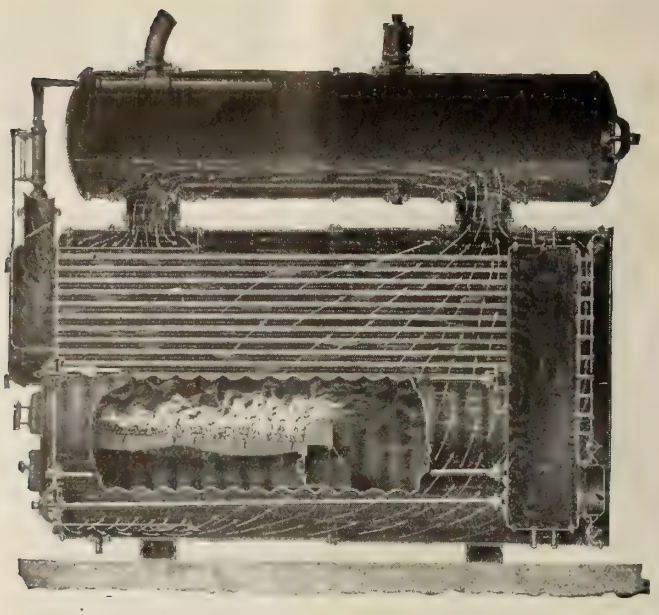
Let us put you in touch with some users.

Write for catalog.

The Jenckes Machine Co., Limited

Sherbrooke Montreal St. Catharines Cobalt South Porcupine Nelson Vancouver

Works: SHERBROOKE, QUE., ST. CATHARINES, ONT.



BOILERKRAFT—

WHILE all boilers must conform to the rules formulated by government authorities, there still exist opportunities for differences in quality. Only the highest limits—not the lowest which may suit the inspector—set the standard in the construction of

ROBB BOILERS

The material must test better than the rules call for even if it costs considerably more.

The shop processes, punching, reaming, rolling, and riveting will produce the safest and most durable boiler only when executed with great care and skill and this is insisted upon even if more time is required in building a Robb boiler, whether it be a horizontal, vertical, or Robb Scotch Marine type which is a self-contained boiler giving highest economy in plants ashore by combining positive rapid circulation with internal firing.

Robb boilers represent the highest grade of workmanship known to the boiler makers' art.

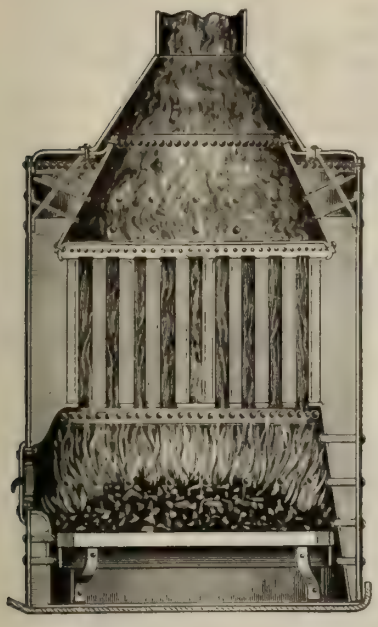
International Engineering Works, Limited

Amherst, N.S. **South Framinghan, Mass.**

DISTRICT OFFICES:

Transportation Bldg., Montreal - R. W. Robb, Mgr.
Union Bank Bldg., Winnipeg - W. F. Porter, Mgr.
Traders Bank Bldg., Toronto - Wm. McKay, Mgr.
Grain Exchange Bldg., Calgary - J. F. Porter, Mgr.

39-48



You Will Benefit By

a thorough investigation of our boilers.

They are the result of long experience, best materials and expert supervision.

Look up the past and present record of our boilers.

We will take the greatest pleasure in getting you in touch with some users—the evidence of users will cost you nothing. Our boilers will do the same for you as they do for others.

WRITE TO-DAY.

We build various types:

Scotch, Clyde, Fitz-gibbon, Vertical, Mosher.

Highest Grade BOILERS

Horizontal, Tubular, Vertical, Locomotive Type, "Heine" Water Tube.

Polson Iron Works,

LIMITED

Steel Shipbuilders, Engineers and Boilermakers

TORONTO, CAN.

Representatives in Canada for

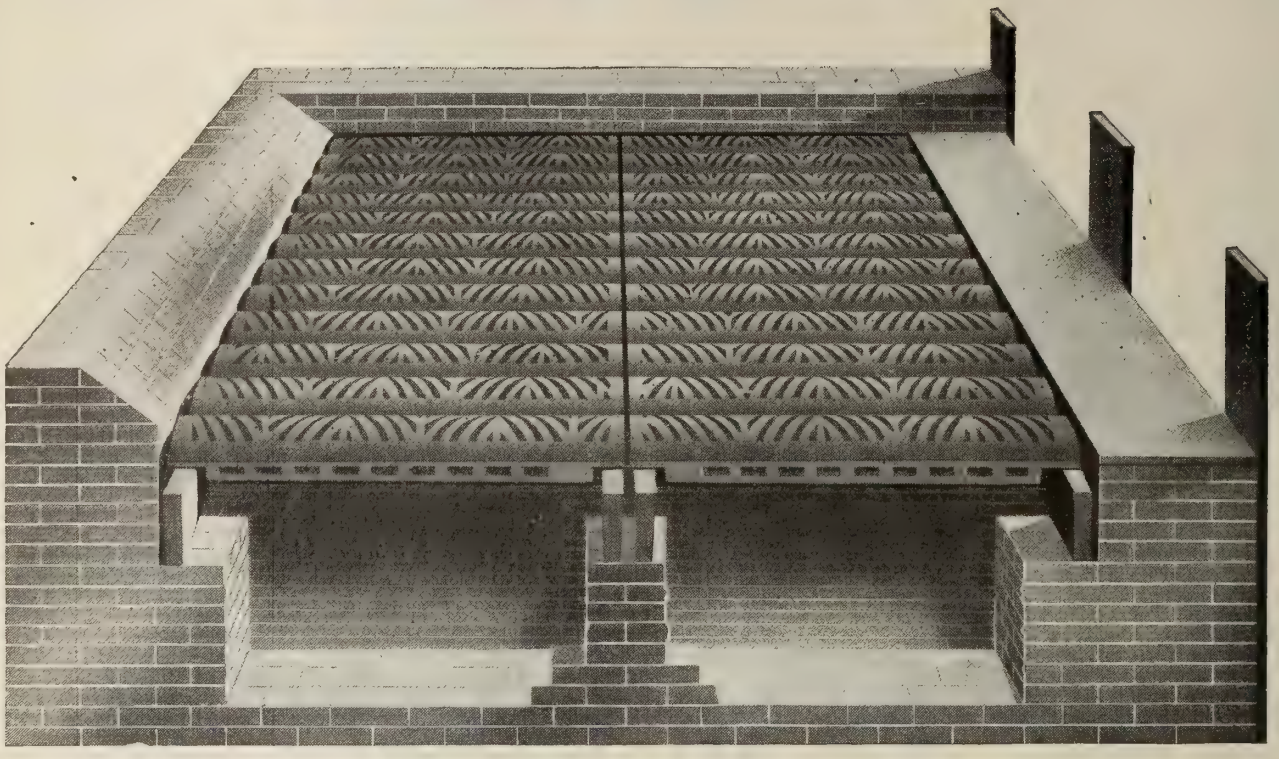
The B. F. Sturtevant Co., Hyde Park, Mass., U.S.A. Fans, Blowers, Heating and Ventilating.

The John I. Thornycroft Co., London, Eng., Marine Motors.

THOMAS ELLIPTIC GRATE BARS

SHAKING—CIRCLE—STATIONARY

FOR EVERY FUEL



THOMAS IDEAS

PATENTED

THOMAS ELLIPTIC GRATE BARS	INCREASE STEAM—SAVE FUEL—SAVE LABOR —COST LESS—REDUCE SMOKE.
THOMAS GRATE RESTS	EVERLASTING—PRESERVE GRATE BARS—PROTECT FIRE WALLS.
THOMAS FURNACE SETTING	FIRE WALLS—BRIDGE WALL—FRONT WALL independent of all expanding and contracting irons. SEE THAT AIR SPACE COMPLETELY ENCIRCLING THE GRATE AREA. No dead and burned grate bar ends. No pushed down walls from expansion of grates.

Shipped from Hamilton, Ont. **Let us give you complete information.**

FOR ALL PROBLEMS

Steam—Grate Bar—Furnace—write THOMAS

The General Supply Co. of Canada, Ltd.

OTTAWA TORONTO WINNIPEG

THOMAS GRATE BAR CO., **Birmingham, Ala., U.S.A.**

The advertiser would like to know where you saw his advertisement—tell him.

"THE Cyclone"

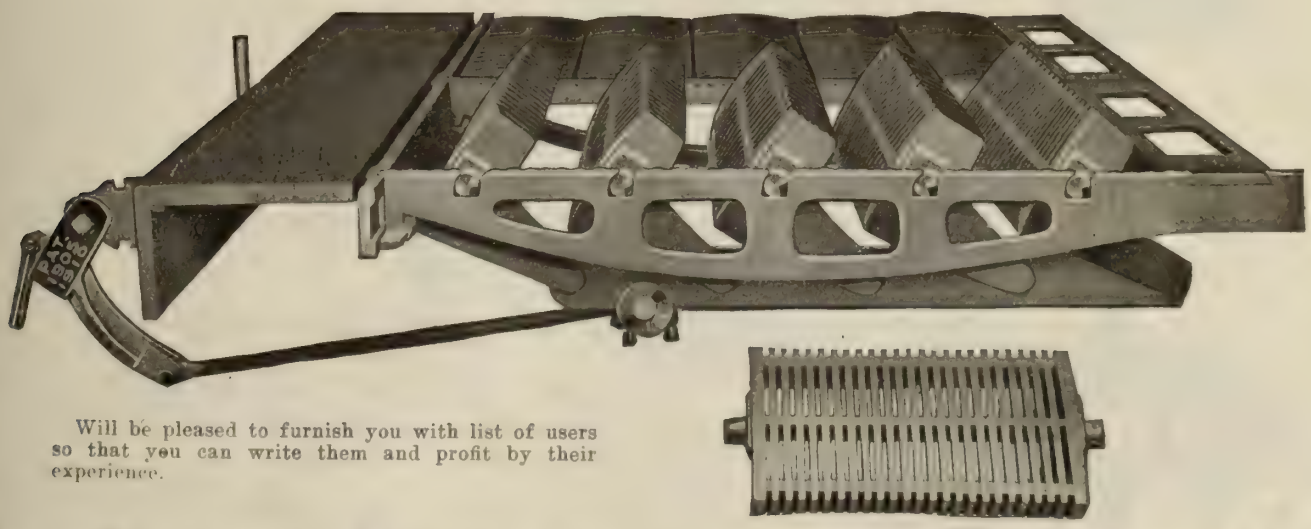
Shaking and Dumping Grate Bar

Because of their merit and superiority these grates will soon replace every other make in the progressive power plants in Canada.

Locks level, cannot get out of adjustment or become warped, 63 per cent. air space, 90 per cent. under draught, more vigorous and effective shaking is the result of improved shaking mechanism—no ashes can cling to the centre of the grate, burns the cheapest grades of fuel with results equal to that of the best, generates more steam from less fuel than any other. Built upon the plan to enable the engineer to fire light and keep his fires free from ash.

They are imitated in design and construction, but **not** in quality.

When on the market for grates it will be to your advantage to see that you get a "Cyclone."



Will be pleased to furnish you with list of users so that you can write them and profit by their experience.

The Canadian Steam Boiler Equipment Co., Limited

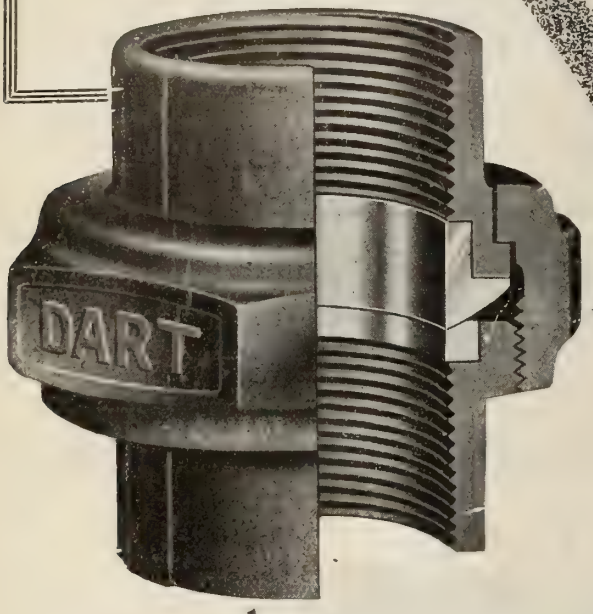
SOLE MANUFACTURERS FOR CANADA

211 QUEEN STREET EAST :-: :-: :-: **TORONTO, CANADA**

AGENTS

ST. JOHN, N.B., F. W. Blizard, Canada Permanent Chambers. MONTREAL, H. L. Peiler & Co., 308 St. James Street.
HAMILTON, Robt. Fitzsimmons, 8 Grove Street. CALGARY, Alta., The Western Foundry & Metal Co., Limited.
BERLIN, J. Hainsworth, 14 Foundry Street. WINNIPEG, Vulcan Iron Works.

Bronze to Bronze At The Joint



The unions that are efficient and economical.

Make joints easily and quickly, whether pipes are in or out of line.

Stay tight until deliberately loosened.

May be connected time after time without lessening their efficiency.

Bronze to bronze joint prevents rust and corrosion. Heavy iron ends withstand all stress.

Contraction, expansion or vibration, either inside or outside the pipe, will not affect them.

Your jobber or supply man sells them.

The name "Dart" is cast on every union and assures you that they are Dart Unions.

The DART Union

DART UNION CO., Limited

93-97 Niagara St., Toronto, Ont.

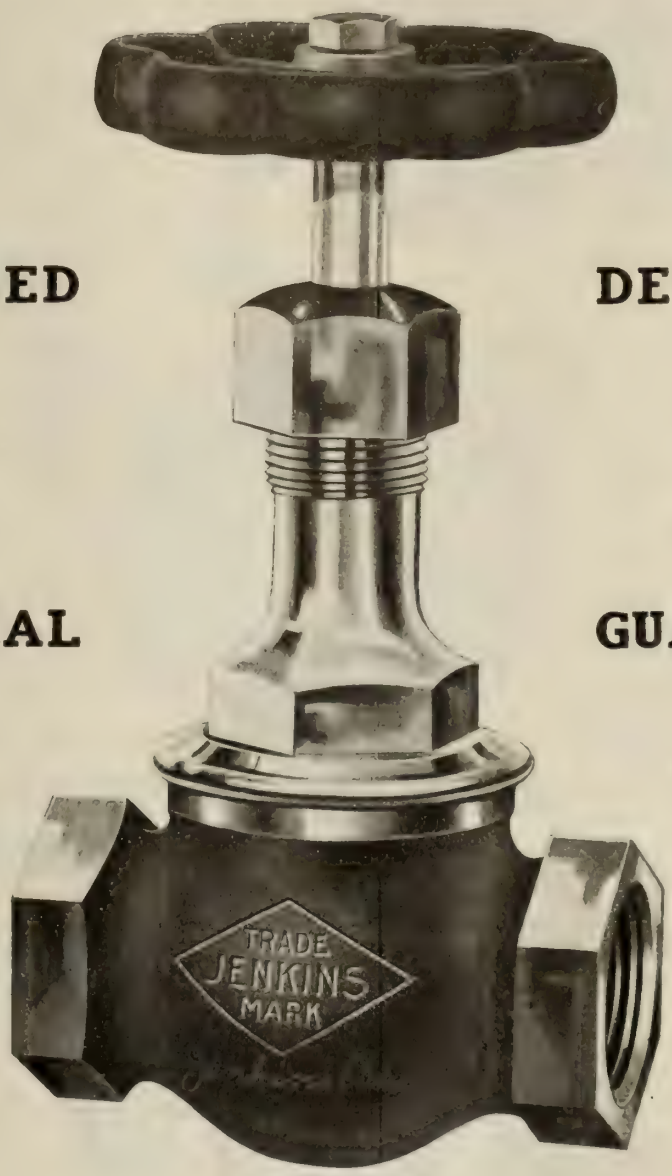
Jenkins Bros.' Valves

UNEQUALLED **DEPENDABLE**

TRADE JENKINS MARK
Jenkins Bros.

TRADE JENKINS MARK
Jenkins Bros.

ECONOMICAL **GUARANTEED**



Approved for use by the Departments of Public Works in the Western Provinces and Ontario.

Write to-day for copy of our catalog.

103 ST. REMI ST. **JENKINS BROS., Limited** MONTREAL

Stop Blow-outs and Leaks in Pipe Lines by Using GOETZE No. 2 ELASTIC GASKETS

If you start right now to renew with No. 2 ELASTIC GASKETS, you can steadily reduce your renewals until you have brought them almost to the vanishing point.

This is not a mere "claim"—it is backed up by a *guarantee*—in fact the strongest guarantee ever made by a gasket manufacturer.

Think what it means to re-gasket a joint so it will *keep tight for years,* instead of days or weeks. Think of the saving resulting in gasket costs, labor and shut-downs.

What No. 2 Elastic Gaskets Will Do

No. 2 ELASTIC GASKETS will make the most troublesome joint you have absolutely tight — and keep it so. They "stay put" and stay tight. Prevent leaks, blow outs and shut-downs. Will practically eliminate renewal expense for gaskets.

No. 2 ELASTIC GASKETS are for high pressure and super-heated steam lines, but owing to their indestructible nature, are equally adapted to *any and every condition* about a factory, mill or refinery.

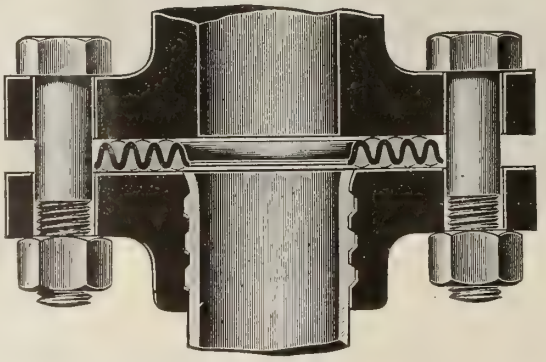
The No. 2 Elastic Guaranteed

Every No 2 Elastic Gasket is Guaranteed for 5 Years Continual Service in the Same Joint

There are no "ifs and ands" about this guarantee. It means just what it says. It applies to every No. 2 GASKET whether bought direct from us or through a dealer.

How No. 2 Elastic Gaskets are Made

These Gaskets are made of corrugated copper with asbestos lining No. 2. The corrugations allow for expansion and contraction of the pipes, while the asbestos, being forced into the



pores of the metals in the flanged surface by the "squeeze" and the constant pressure of the corrugations beneath it, holds securely against the highest pressures.

Goetze Gaskets are carried in stock by

T. McAVITY & SONS, LIMITED

ST. JOHN, N.B.

MONTREAL
112 St. Peter Street

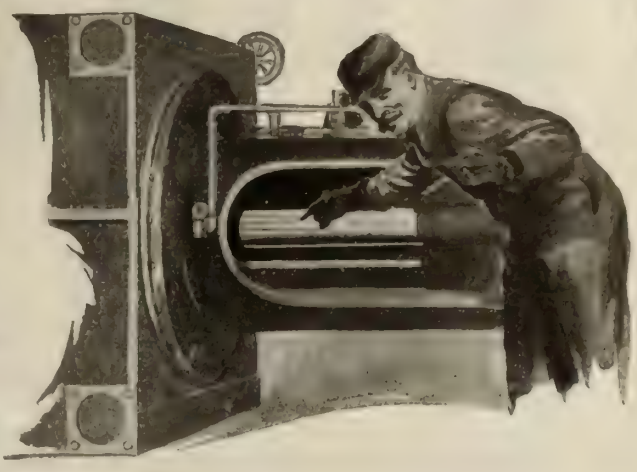
BRANCHES AT
WINNIPEG
C. E. Chown, 147 Bannatyne Street

VANCOUVER
c/o A. O. Campbell, 1069 Hamilton Street.

MANUFACTURED BY

Goetze Gasket & Packing Co., New Brunswick, N.J.

"Even Scored Rods Are Kept Steam-tight"



Rods that are scored and pitted so they will not hold steam-tight with "solid" or other styles of packings, do not "blow" or leak when packed with P. P. P.—and this with a slack gland.

P. P. P. is the "sliding wedge" and "compressible cushion" packing which saves over 75 per cent. of the friction other packings create under like conditions.

DANIEL'S ROD PACKING P. P. P. COIL RING SPIRAL

"A long and careful series of tests made by mechanical engineers of the best grades of fibrous packings, compared with Daniel's P. P. P. Packing, proved that the solid packings, or those not self-setting, increased the friction on the rods so that it required from 2.31 to 7.27 more horse-power to maintain the same piston travel, while the increased friction on the rod of the solid packings ranged from 11.62 per cent. to 59 per cent. The money value of power saved by the use of Daniel's P. P. P. Packing, as shown by these tests, ranged from $104.96 to $250 a year per rod, while the solid packings exceeded P. P. P. in cost from 80 to 240 per cent." "The Story of Some Friction Tests."

A Minnesota chief engineer writes: "I have used P. P. P. for six years. On one engine the piston was badly pitted and scored. With other packings I had a great deal of trouble keeping the rod from smoking, but after I put in two rings of Daniel's P. P. P. (Special) I had no more trouble with a hot rod."

How to Get the "Slide Valve" FREE

Fill out the Coupon, and mail it to us. We will address a book to you, and send it FREE of charge.

Your Name .....

Address .....

Employed by .....

Address .....

Horsepower of Engine .....

Kind of Rod Packing Used .....

Do You Use **EBONITE** Sheet Packing? .....

Dealer's Name .....

Address .....

Name of Buyer .....

..... Series 24

Daniel's P. P. P. is the **original** self-setting rod packing. None but the genuine has ever been tested scientifically. Order enough to pack your engine one time — you'll use no other.

If your dealer does not keep P. P. P., write us, and we will see that you are supplied.

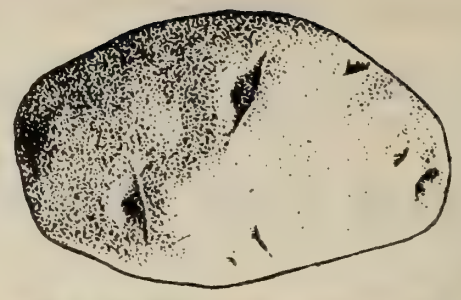
QUAKER CITY RUBBER COMPANY

Manufacturers of Mechanical Rubber Goods

PHILADELPHIA, PA. U.S.A.

The advertiser would like to know where you saw his advertisement—tell him.

POTATO SCALE BOILER CLEANSER



Saves Tubes **Saves Fuel**

TRY IT
At Our Expense

We guarantee this boiler cleanser to remove old scale and prevent any new scale from forming; also that it will prevent pitting, corrosion, foaming, etc.

Send us a gallon of feed water for analysis and we will mix a quantity for your approval. If not satisfied, it will not cost you a cent.

Ask for a sample of our
NUMIDIAN CYLINDER, VELOX ENGINE and SLIPTIVITY MACHINE OILS

These oils form a triple combination that is hard to beat. Once you have tried them we are confident of your regular patronage.

Increases Boiler Efficiency

Harmless To Fittings

C. C. SNOWDON

1810-1840 11th STREET EAST, CALGARY, ALBERTA. **P.O. Box 1384**

Refiner, Importer and Manufacturer of

Pennsylvania Lubricating and Refined Oils, Gasoline, Potato Scale Powder, Liquid Soap, Disinfectants, Polish, Waste, Oil Tanks, etc.

Twenty Years Without Scale!

Take a new boiler and use Perolin in it from the first day and at the end of twenty years you will have an absolutely scale-free boiler. In all the twenty years you will not have to use a tube cleaner, nor any method of cleaning. Perolin will keep the metal as clean as a whistle.

Perolin will also clean old boilers and once clean will keep them clean at a remarkably small expenditure.

Our claims are backed by the strongest kind of guarantee. If you can make it stronger, do so, and we will back it to the limit.

Perolin

from Germany

Here's Our Guarantee

Perolin German Boiler Metal Treatment is Guaranteed

1. To remove scale already formed in your boilers.
2. To prevent new scale from forming.
3. To stop all pitting, corroding and galvanic action.
4. Not to corrode or injure the boiler metal or packing.
5. Not to affect or impart any off-odor to steam generated from the water.
6. To correct oil troubles, caused by oil or grease getting into boiler water.
7. Not to affect the products of Breweries, Ice Plants, Creameries, Dye Works or any product where live steam is used in the manufacture of their goods.
8. That it does not affect the water, neither is it affected by the water and that the Perolin Preservative Film is a good transmitter of heat.

Our Unusual Offer

We are so confident that we can cure **your** scale troubles (under the above guarantee) that we will ship you enough Perolin for a 60 days' test, **freight prepaid.** You use it for 60 days and then, when we have satisfied you that we have the **only** real scale remedy and preventative, you can pay us—not before.

Perolin is not new and untried. For 18 years it has been successfully used throughout Europe, and to many old country engineers in this country it will be familiar under its German name of "D. R. Dampf Kessel-Mischung."

It has been on the U. S. market for three years, has been widely advertised, and is now in use in over 10,000 of the best and most efficiently engineered plants in America.

You will be in mighty good company if you become a Perolin Engineer.

A Mechanical Not a Chemical Action

Perolin has no chemical action whatever, and cannot injure metal or packings.

By its affinity for the boiler metal Perolin is drawn through the cracks and pores in the scale. As soon as it comes into contact with the heated metal it expands and pushes the scale away, gradually breaking down the entire scale formation, and leaving the metal absolutely clean. Perolin then deposits a Preservative film on the metal, and your scale, pitting and corroding troubles are over for good.

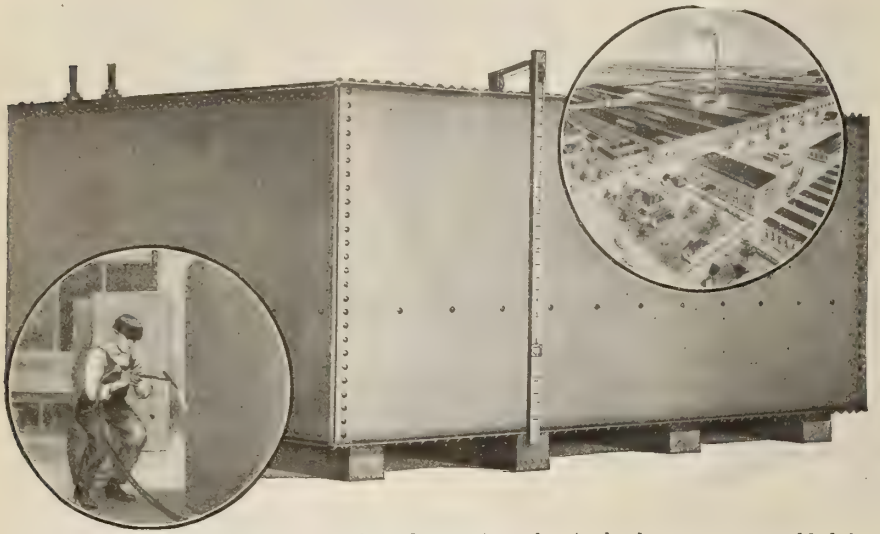
Used in new Boilers Perolin will keep them clean for twenty years.

Write for interesting literature on Perolin. The day you write will figure as a lucky day in your calendar ever after.

The Perolin Company of Canada

Standard Bank Building - - Toronto

Twenty-eight years of experience in building tanks, a trained force of workmen and this immense plant are behind every Bowser Tank.



Good workmanship means good tanks. Our rectangular tanks have corners welded by oxy-acetylene process. A safety factor of six is allowed on all tank work.

Reduce Oil Cost By Better Storage

Instead of keeping oil in barrels piled about a warehouse floor—instead of having sloppy floors and heavy handling expense—your oil can be purchased at large quantity prices, unloaded from the oil-car and any number of gallons stored without danger of leakage, fire or obnoxious odors in

Big Oil Storage Tanks

Every factory can profit by handling oil systematically—can eliminate waste by installing Bowser Storage Tanks. Improper handling methods mean spilling, evaporation, leakage, slop, fire-risk—poorly constructed tanks only add to these losses by being a constant menace and trouble.

Whether buried under an oil shed, installed in the damp cellar of a warehouse, or located in some other out-of-the-way corner—Bowser Oil Storage Tanks are ready to meet the most adverse conditions—are proof against rust, electrolysis or corrosion.

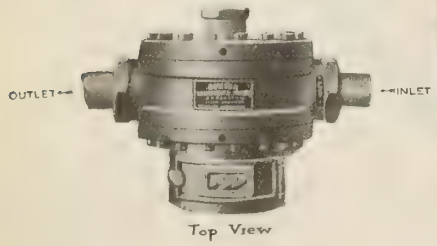
Bowser Tanks are carefully built of high-grade materials by skilled workmen—they're guaranteed to withstand the wear and tear of many years.

Write for our illustrated catalogue and booklets on the various phases of oil handling. They fully describe our storage methods they show the best apparatus for each use. Tell us what you need in this line, and we will gladly furnish a free estimate without obligation. It means a big saving for you—so write to-day.

OTHER OIL HANDLING EQUIPMENT WHICH SAVES.

Our line of oil handling equipment is complete in every way. Smaller tanks receive the same thorough study and construction as the larger storage tanks—while our pumps and measuring instruments insure the greatest saving in handling expense.

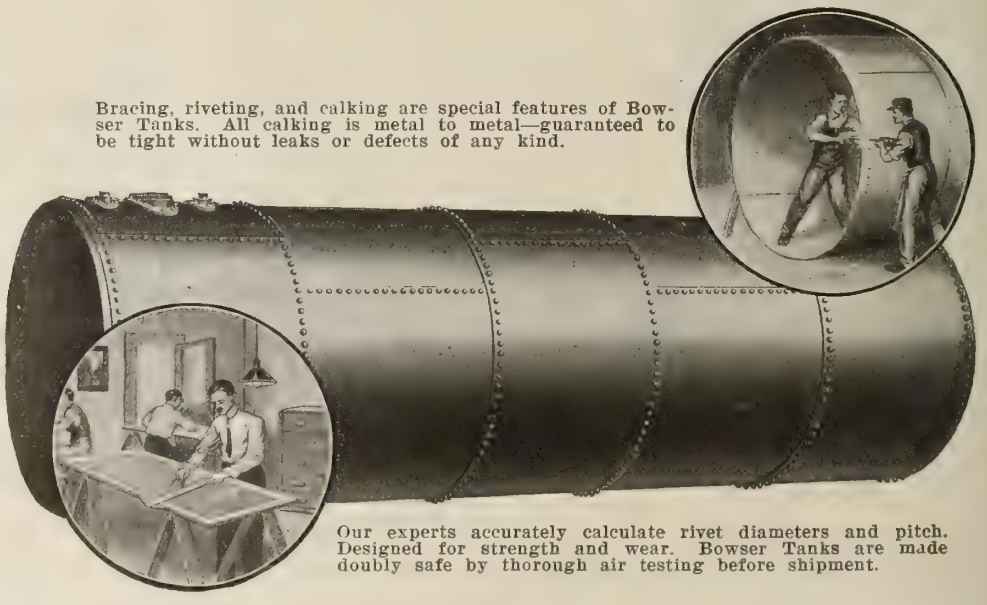
REGISTERS EVERY GALLON.



Top View

"Here's one of our devices which automatically records and controls the flow of oil through a pipe line of any diameter up to 10 inches, whether the force is supplied by gravity or by pressure. The Register will also automatically stop the flow at any desired amount."

Bracing, riveting, and calking are special features of Bowser Tanks. All calking is metal to metal—guaranteed to be tight without leaks or defects of any kind.



Our experts accurately calculate rivet diameters and pitch. Designed for strength and wear. Bowser Tanks are made doubly safe by thorough air testing before shipment.

S. F. BOWSER & CO., Inc.

66-68 Frazer Ave. **Toronto, Ont., Canada**

MADE BY CANADIAN WORKMAN AND SOLD BY CANADIAN SALESMEN

Sales Offices in all centres and Representatives everywhere

Original Patentees and manufacturers of standard, self-measuring, hand and power driven pumps, large and small tanks, gasolene and oil storage and distributing systems, self-registering pipe line measures, oil filtering and circulating systems, dry cleaner's systems, etc.
Established 1885.

ANOTHER RECORD

SHOWING SMALL FRICTIONAL CO-EFFICIENT OF

MAGNOLIA METAL

IN TEST BY THE

FRENCH GOVERNMENT

RESULTING IN ITS RECOMMENDATION FOR USE BY THE

FRENCH NAVY

Pressure, 710 lbs. per square inch. **Surface velocity, 6.56 feet per second**

Lubricant — Black Oil

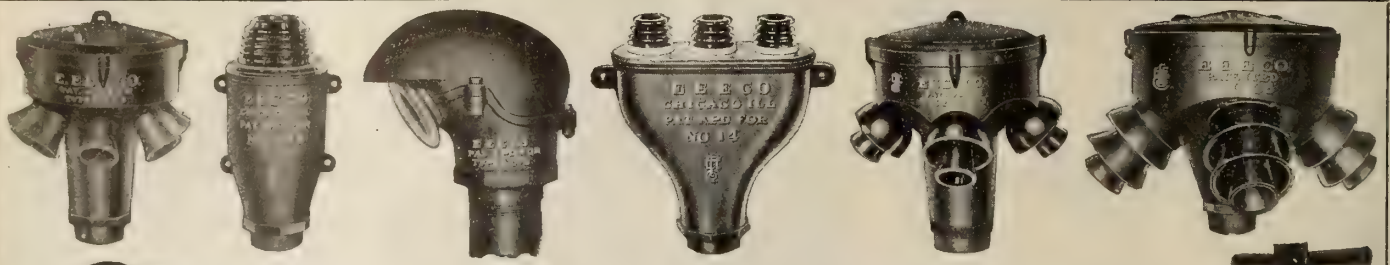
Time in Minutes.	Co-efficient of Friction.	Temperature of Left Bearing-Fah.	Temperature of Right Bearing-Fah.
.40	0.0016	107.6	107.0
.50	0.0015	111.2	109.4
1.00	0.0015	112.0	112.0
1.30	0.0013	118.4	116.6
2.00	0.0012	120.2	119.0

SOLD BY LEADING DEALERS EVERYWHERE OR BY

MAGNOLIA METAL CO.

OFFICE AND FACTORY:

225 St. Ambroise St. MONTREAL



WARNING

Just one word of warning. Before you buy your electrical specialties for your proposed station or transmission requirements, let us quote you upon your needs.

Pole Top Disconnecting Switches in three types, opening all poles at once from the ground and Station Disconnecting Switches, any style. Also Cable End Bells, Bus Bar Supports, Switchboard and Pipe Frame Fittings, Clamp Insulators, Station Pins, and many other specialties, all covered by our five-year guarantee.

Write for the Engineers' Equipment Catalogue

THE Northern Electric AND MANUFACTURING CO. LIMITED

Montreal Halifax Toronto Winnipeg Regina Calgary Edmonton Vancouver

Across Canada

with the

Imperial Wire & Cable Company, Limited

Toronto Montreal Winnipeg

First of a series of advertisements showing buildings of national importance which have been wired with Imperial Wire & Cable Co., Limited, wires.

This picture shows

The Ritz-Carlton Hotel

Montreal

Architects—Warren & Wetmore—New York;
Engineers—Mailloux & Knox—New York;
Electrical Contractors—J. Livingston & Co.—New York.

This hotel was wired with "Imperial" Higrade Rubber Insulated Wire.

Address inquiries to nearest office

Montreal Toronto Winnipeg

Alberta and British Columbia enquiries to our Sales Agents, the Northern Electric and Manufacturing Co., Limited, Calgary and Vancouver.

The advertiser would [illegible] saw his advertisement—tell him.

Catch Trouble by the Forelock

Don't Worry

Be Prepared

Get a supply of

Garlock Palmyra Red Sheet Packing

for your

Steam Lines, Cylinder Heads, Steam Chest Covers.

This sheet packing is made of high grade rubber compounded in such a way as to give it great strength and reliabity. It has met with universal success and has established a wide reputation on its own merits. Write for samples and prices.

Have you a Garlock catalogue?

The Garlock Packing Company

HAMILTON, ONTARIO

Montreal Toronto Winnipeg

Pioneers in the Packing Business

SUNBEAM MAZDA

Drawn Wire

TUNGSTEN LAMPS

Your Lighting Problem Is One of Vast Importance

The quantity and quality of your work hinges upon the lighting system.

It stands to reason that an improperly lighted plant is a handicap to employees and injurious to the product.

A "Sunbeam" Mazda Lamp gives a clear white light which is three times greater than that of a carbon lamp and consumes less electricity.

They are strong and durable, and are not affected by vibration.

Made in Canada by

The Canadian Sunbeam Lamp Co., Ltd.

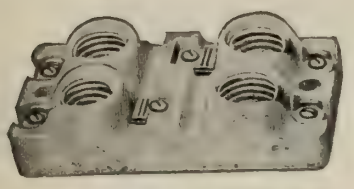
Main Office and Factory: Toronto, Ont.

Branch Warehouses:

MONTREAL WINNIPEG CALGARY VANCOUVER

DUNCAN

Edison Plug Cutouts and Entrance Switches of Duncan Quality



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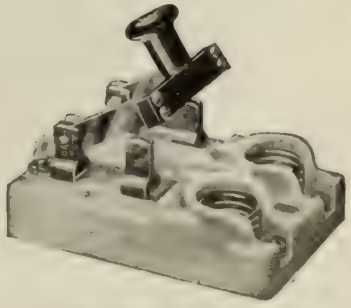


No. 1695 (¼ Full Size)

TRADE DUNCAN MARK

There's Your Guarantee

ORDER THROUGH YOUR JOBBER

The Duncan Electrical Co.

Limited

Montreal

Makers of Electrical Supplies

D E Co

The advertiser would like to know where you saw his advertisement—tell him.

Use Stephenson Bar Belt Dressing

Make 1913 a record breaking year. Turn over a new leaf and get rid of the things that have been causing needless trouble and expense. Adopt the things which will make your work easier, give better results and save money for your employer. You cannot start at a better place than with your belt dressing.

Get rid of your troublesome liquid dressing. Shake the can for the Stephenson solid stick and shake trouble at the same time.

Stephenson Bar Belt Dressing is a friend in need. It doesn't require preparation, nor do you have to use special care in applying it. The minute the belt slips you hold the Stephenson bar to the belt for a few seconds and the slipping stops. There's no waste—no slop—no smearing on of paste or pouring on of spattering liquid. And the results are better.

I'll "Stick to the Solid Stick"

Start With a Free ½ Lb. Sample

Simply send us your name and address and we ll send you a present in the shape of a free half-pound sample of Stephenson Bar Belt Dressing.

Remember—we give you this sample absolutely free of charge. Get this free half-pound of the finest belt dressing made and test it. Here's your chance to try somesomething really good at no expense.

None Genuine Without Trade-Mark

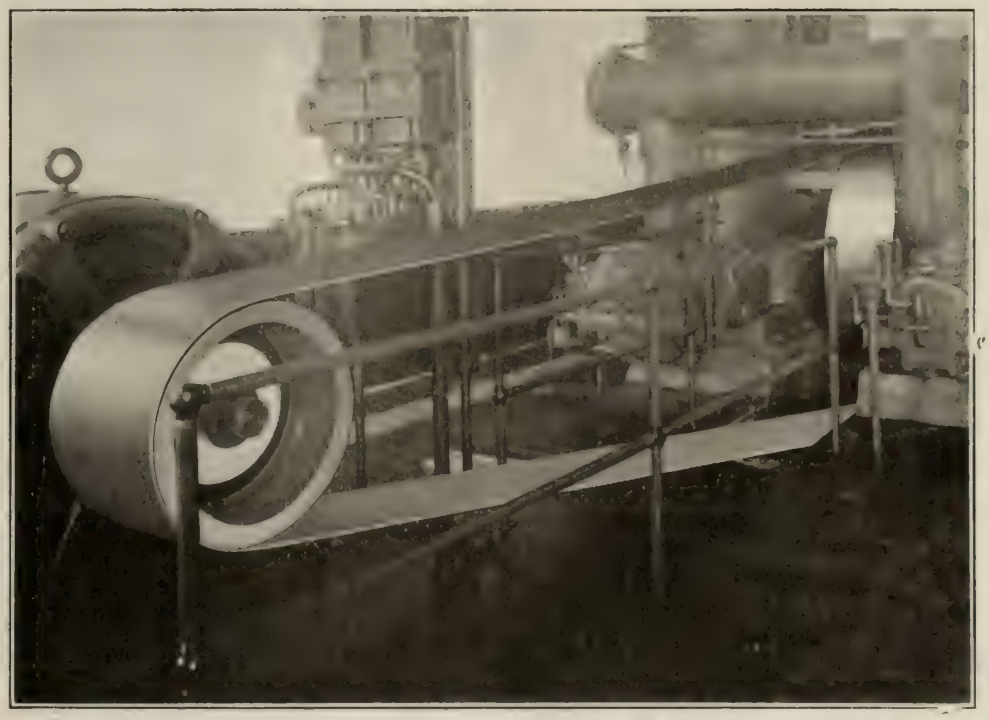
Stephenson Manufacturing Company

Est. 1888 Albany, N.Y. **Inc. 1897**

The advertiser would like to know where you saw his advertisement—tell him.

Let Tried and Proven Service Quality Settle Your Belting Problems

Scandinavia and Lanco Balata Belts have behind them many years of successful demonstration of quality to establish every claim made for them.



Either Scandinavia or Lanco Balata Belting may be used here to equal advantage.

Scandinavia

is particularly well adapted for both main and direct drives. It does not matter whether the drives be straight or crossed. The friction resisting quality of Scandinavia belting prevents any injury from the rubbing of a crossed belt. This means you can save a great deal of money by using it, as its life is great, it has good surface for clinging to the pulley, it runs true, it is flexible and is enormously strong. For the special purposes to which it is adapted Scandinavia is the least expensive belt you can buy because it is the most serviceable.

Write for New Belting Book "THE MAIN DRIVE"

Lanco Balata

is strongly recommended for use in places where the conditions change from wet to dry. Unlike Scandinavia this belt can be made endless and will stand up under high speed. It is not affected by cold or moisture. This is also an exceptionally high-grade belt. It is made of the very best quality of cotton, as tightly woven as possible, and is thoroughly impregnated with pure Balata gum, ensuring the highest service-giving quality.

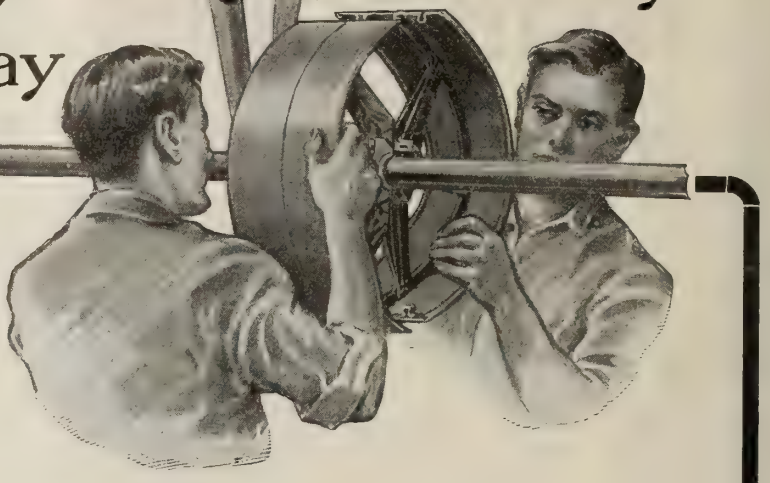
Federal Engineering Company, Limited

Toronto
90 Sherbourne St.

Montreal
Unity Building

The advertiser would like to know where you saw his advertisement—tell him.

Install Your Pulleys the Quick and Easy "AMERICAN" Way



HOW much time and money do you lose every time you install a new pulley or change a pulley from one shaft to another? Figure it out. Most engineers and mill men, who take the trouble to make this calculation, adopt the

"American" Steel Split Pulley

Perfect in Principle Powerful in Performance

A mechanic and helper, with a wrench, can install an "American" pulley during the lunch hour on any size shaft. No stripping, no need of key-way or set screw—just tighten a few bolts, and be sure you tighten them evenly.

When the one o'clock whistle blows, you have a pulley much safer than any other type, which will perform double belt service under any conditions not requiring a special pulley.

Some "American" Superiorities

Forty-five per cent. lighter than cast iron pulleys; stronger than any other steel pulley; with grooved air escape on face, improving belt contact.

"A"-braced arms give perfect rigidity, while offering least air resistance.

"Americans" are particularly well balanced and are, by far, the truest steel pulleys made —truer than some turned pulleys.

PATENTED

The American Pulley Company
PHILADELPHIA, PA., U. S. A.

CANADIAN AGENTS:

Williams & Wilson, Limited, Montreal, Quebec.
A. R. Williams Machinery Co., Limited, Toronto, Ont.
A. R. Williams Machinery Co., Limited, St. John, N.B.
A. R. Williams Machinery Co., Limited, Winnipeg, Man.
A. R. Williams Machinery Co., Limited, Calgary, Alberta.
A. R. Williams Machinery Co., Limited Vancouver, B.C.

Physically Qualified

was the Spartan of old; trained from his youth to resist hunger, cold and exposure to extreme hardships.

"SPARTAN" BELTING

is made to resist the action of those elements which would otherwise shorten its term of usefulness. It is absolutely proof against the ordinary curses of beltdom—heat, friction, water, steam, oil and acid fumes—that we guarantee, and furthermore, that a Spartan belt will last longer, give better service, and with greater economy, than any other belting working under the same conditions.

Pick out the most difficult drive in your plant — not one of the easy, ordinary ones, but the place where the conditions are the worst, where other belts have failed to meet the demands—let us install a Spartan on that drive, you'll be amazed at the increased efficiency—an increase you thought impossible.

Write for full particulars and copy of the Spartan Book.

We will also send you, free of charge, copy of our free text book on the Care of Belting. Both are invaluable to every belting user.

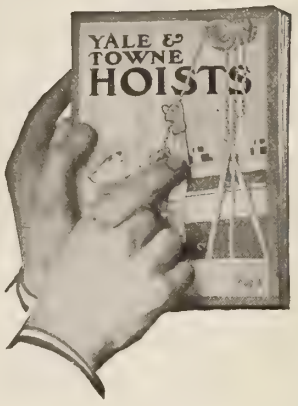
THE

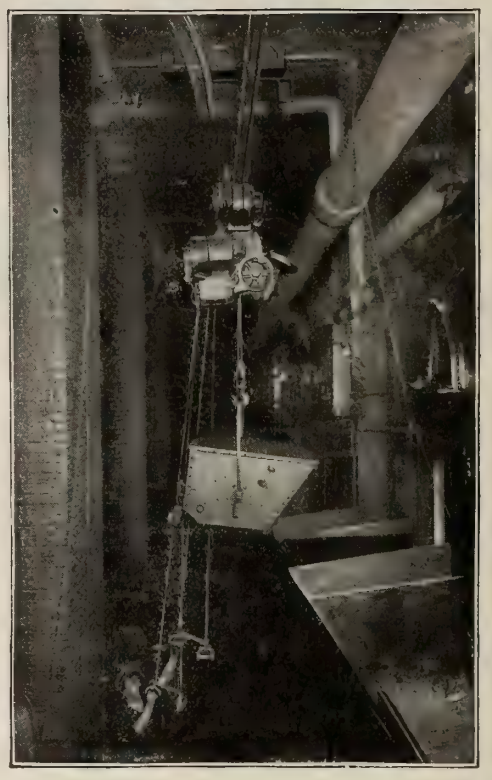
Graton & Knight Mfg. Co.

Worcester, Mass., U.S.A.

Kansas City, Mo.,	Atlanta,	New York,
Philadelphia,	Chicago,	St. Louis,
Pittsburg,	Detroit,	Seattle,
Cleveland,	Milwaukee,	Minneapolis,
Portland, Ore.,	Boston,	San Francisco.

THE TRIPLEX BLOCK





The Best Practice in Power Plants

THE new book of Hoists shows modern boiler room installation for handling coal by electric hoist and trolley. Under 4,000 lb. loads these hoists travel 350 feet per minute from bunkers to furnace, controlled from the floor or from a trailer cage.

Both for the Power Plant or Marine Engineer this book shows the latest application of chain blocks and trolleys to enable one man to lift, move and adjust any load up to 20,000 pounds.

Write for a copy of this book to-day. It will result in decreased costs in handling.

Safety of Steel

The Triplex Block is steel construction—steel in all load bearing parts, sheave, gears, pinion, hooks and chain.

EACH BLOCK TESTED TO 50 PER CENT OVERLOAD

Yale Products—Locks, Padlocks, Builders' Hardware, Door Checks and Chain Hoists.

Also Duplex Blocks, Differential Blocks and Electric Hoists.

THE CANADIAN FAIRBANKS-MORSE COMPANY
LIMITED

Montreal St. John Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver Victoria

D. K. McLaren's

Genuine British Oak-Tanned

Leather Belting

No Other
Tanning Process
Gives Leather So Much
STRENGTH

Leather that is tanned by the acid process is weakened and soon goes to pieces on the pulleys.

Don't be Misled by the Appearance of Belting.

All makes may look alike, but give a vastly different kind of service.

We want you to investigate D. K. McLaren's Belting, and will take pleasure in connecting you with some users. It will give you the same kind of service that it is giving others.

D. K. McLaren's Belting will greatly reduce your power transmission cost. You will admit this after you have given it a trial.

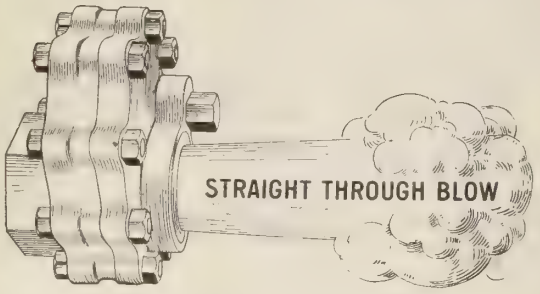
Write us to-day.

Our trade mark is our guarantee—it is found on every few feet of belting.

D. K. McLaren, Limited

Montreal 351 St. James St. | **Toronto** 200 King St. W. | **Vancouver** 37 Alexander St. | **St. John, N.B.** 64 Prince William St.

EVERLASTING
BLOW-OFF VALVES



IT NEVER LEAKS!
WRITE FOR PRICES

200,000 IN USE

Does your Boiler leak, Mr. Engineer?
How often do you blow it?
The "EVERLASTING" is the only perfect blow off valve on the market.
No stuffing box—requires no packing—is self-cleaning, and has a self-grinding seat—nothing to get out of order—What's the answer?

RELIABILITY—SIMPLICITY.

SOLD AND MANUFACTURED UNDER CANADIAN PATENTS BY

Engineering Specialties Company, 1080 King St., West, TORONTO
LIMITED

AGENTS

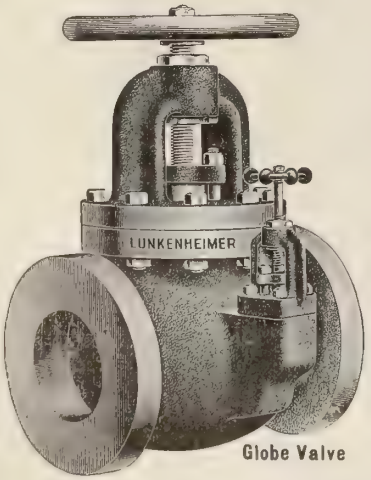
MONTREAL, QUE.
H. L. Peiler & Co.

ST. JOHN, N.B.
The A. R. Williams Mach. Co.

WINNIPEG, MAN.
The A. R. Williams Mach. Co.

CALGARY, ALTA.
P. D. McLaren Limited

VANCOUVER, B.C.
Taylor-Forbes Company, Limited



Globe Valve

LUNKENHEIMER IRON BODY VALVES

DURABILITY and STRENGTH, combined with the **most improved design** and **high-grade workmanship** make them the leaders of their line.

The iron used is made according to our own formula and has a tensile strength of 25,000 pounds per square inch.

All parts subjected to wear are renewable and are made of a good grade of bronze composition containing a high percentage of copper and tin.

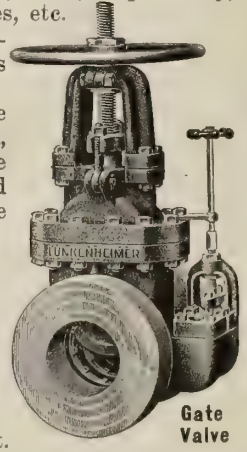
The line consists of Globe, Angle, Cross, Check, Gate, Pop Safety, Relief, Blow-off, Non-return Safety Boiler Stop Valves, etc.

They are made in all standard sizes, and in several weights, the heaviest being for working pressures up to 250 pounds.

For superheated steam and severe service these valves can be had made of "**Puddled**" **Semi-Steel**, having a tensile strength of 35,000 pounds per square inch, or for extreme conditions of service, pressure and superheat, they are made of **Cast Steel**, the tensile strength of which is about 80,000 pounds per square inch.

Your local dealer can furnish them; if not write us.

WRITE FOR CATALOGUE.



Gate Valve

THE LUNKENHEIMER COMPANY

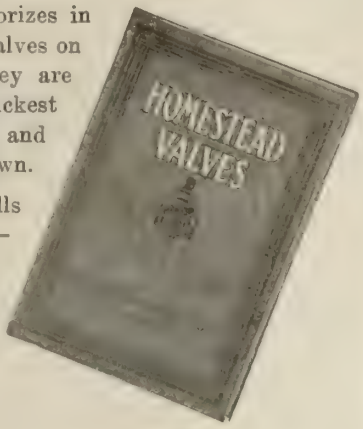
Largest Manufacturers of High-Grade Engineering Specialties in the World.
General Offices and Works: CINCINNATI, OHIO, U.S.A.

New York: 64-68 Fulton St.
Chicago: 186 N. Dearborn St.
Boston: 138 High St.
13-46
London, S.E.: 35 Great Dover St.

The Prize Winners

HOMESTEAD QUARTER TURN VALVES

Homestead Valves win prizes in competition with other valves on merit alone, because they are the simplest made, quickest acting, easiest operated and most durable valves known.



The Homestead Book tells the complete story — why these valves are the best and why you should use them.

It's free — write for a copy.

Ask for Catalog "R"

Homestead Valve Mfg. Co.

Pittsburgh, Pa.

PRICHARD'S BABBITTS

ARE

SOLD ON MERIT

They are designed to meet modern machinery conditions.

We want you to know the following of our Brands:

PRICHARD'S EAGLE GENUINE
PRICHARD'S MACHINERY SPECIAL
PRICHARD'S METALLIC PACKING
PRICHARD'S MAPLE LEAF

They represent the best that can be made, for **High Speed, Heavy Pressure,** or **General Purpose** use.

Our Babbitt's are guaranteed to make good, or **No Charge.** Our goods are also guaranteed to be fully up to standard, and our prices, which you will find very reasonable, quality considered, are named for goods F.O.B. your station. Let us tell you about our goods.

It will pay you to send in a trial order.

MANUFACTURED BY

The DOMINION METAL COMPANY

N. B. PRICHARD Prop.

SHERBROOKE, P. Q.

Montreal Selling Agents
Foss & Hill Machinery Co., 344 St. James Street, Montreal

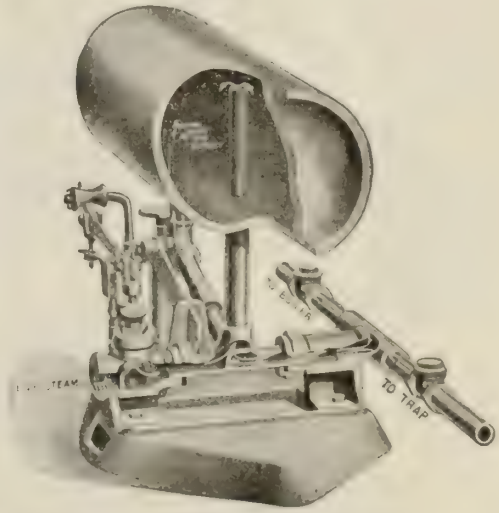
Morehead

Back to Boiler

SYSTEM

Returns all condensation to the boiler regardless of temperature or pressure.

Offers the one practical solution of all your heating and condensation problems—trouble from long steam lines—loss of heat through radiation—condensation waste—trouble with your feed pumps.



Delivers Water Direct to Boilers 100° to 150° hotter than Steam Pump on 90% less steam

Do you ever consider the amount of money you lose by having to cool your condensation 50 or 60 degrees so your feed pump can handle it, and then heat it up again in the boiler into steam?

The Morehead System will more than pay for itself by the saving it makes in your fuel bill.

Ask About Our Trial Trap Offer

The Canadian Morehead Manufacturing Company

WOODSTOCK, ONT.

The advertiser would like to know where you saw his advertisement—tell him.

"THERE is a principle which is a bar against all progress, which is proof against all argument and cannot fail to keep a man in everlasting ignorance. This principle is unreasoning prejudice against full investigation."

WHY NOT INVESTIGATE THE

FULTON WATER-COOLED MECHANICAL STOKER

OTHERS HAVE DONE SO AND HENCE

4,000 HORSE-POWER SOLD

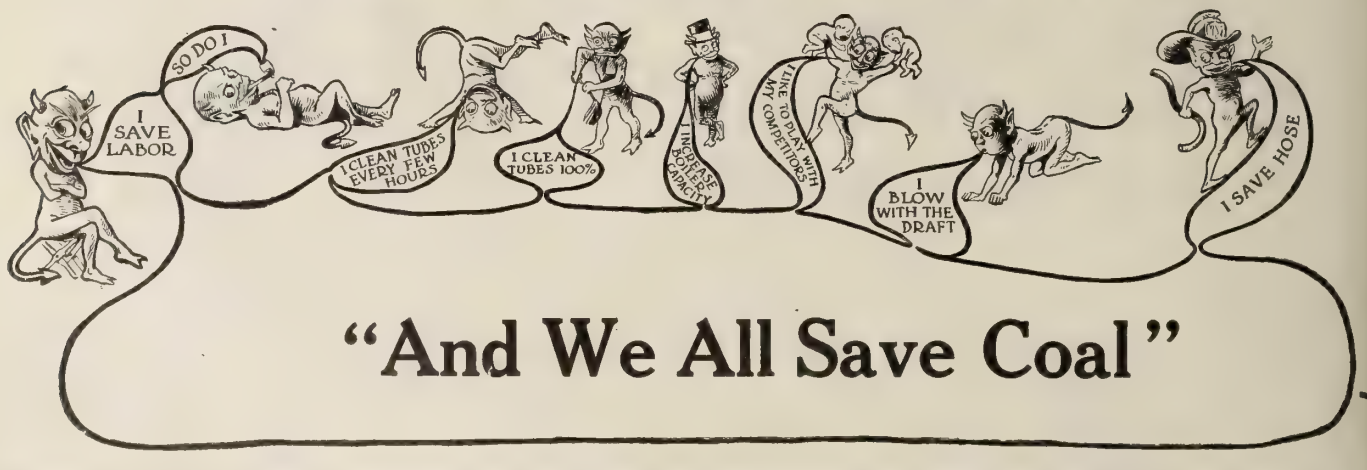
AND INSTALLED IN CANADA IN 1913

Manufactured by

The HARE ENGINEERING COMPANY, Ltd.

14-16 King Street East **TORONTO**

THE VULCAN IMPS


I SAVE LABOR
SO DO I
I CLEAN TUBES EVERY FEW HOURS
I CLEAN TUBES 100%
I INCREASE BOILER CAPACITY
I LIKE TO PLAY WITH MY COMPETITORS
I BLOW WITH THE DRAFT
I SAVE HOSE

"And We All Save Coal"

Wherever the **VULCAN SOOT CLEANER IMPS** are allowed to work they raise the Devil—the Soot Devil. They juggle the heat units and make two units grow where one unit grew before. They make slow steaming boilers "pop" for the first time in years. They give many a weary engineer and fireman a chance to rest. The IMPS are always on the job, "they work while you sleep." They cut out lost time, trouble and repairs. They are good for the operating man and mighty good for the boiler owner. Don't let Soot, the expense maker, worry you longer. Fill out the coupon, mail it now, and we'll send you our Free Booklet, "Economical Steam Production," which shows how the Vulcan removes Soot, and saves from 5 to 15% in fuel.

Mail the Coupon

Vulcan Tube Cleaning Systems,
LIMITED

42Craig St. West **MONTREAL**

SIGN, TEAR OUT AND MAIL

P.H. 10-12. Date.....

VULCAN TUBE CLEANING SYSTEMS, LIMITED, Montreal.

Please send me, without charge, your book—ECONOMICAL STEAM PRODUCTION, and your proposition.

(It is important that following information be given in full.)

WATER TUBE BOILERS. Number.....Type.....
Pressure .....Horsepower .....No. Tubes H
(except on Stirling boiler .....Any Superheaters .....Width of alley space at side .....
TUBULAR BOILERS. Number.....Horizontal or Vertical .....
Name .....
Address .....

MURPHY FURNACES

OCCASIONALLY we fail to get first contract; WHEN GET FIRST CONTRACT it is in but RARE INSTANCES WHEN DO NOT GET REPEAT ORDER—when additions are made to plant.

Illustrative of this: THE ST. LAWRENCE STARCH CO., Limited, Port Credit, Ont., bought Murphy Furnaces as follows:

1st order	March 1908	3 furnaces, 645 h.p.
2nd "	Feb. 1910	1 furnace, 215 h.p.
3rd "	June 1913	4 furnaces, 600 h.p.
3 contracts—in 5 years:		8 furnaces, 1460 h.p.

REPEAT ORDERS are the best evidence of merit!

For printed matter address:

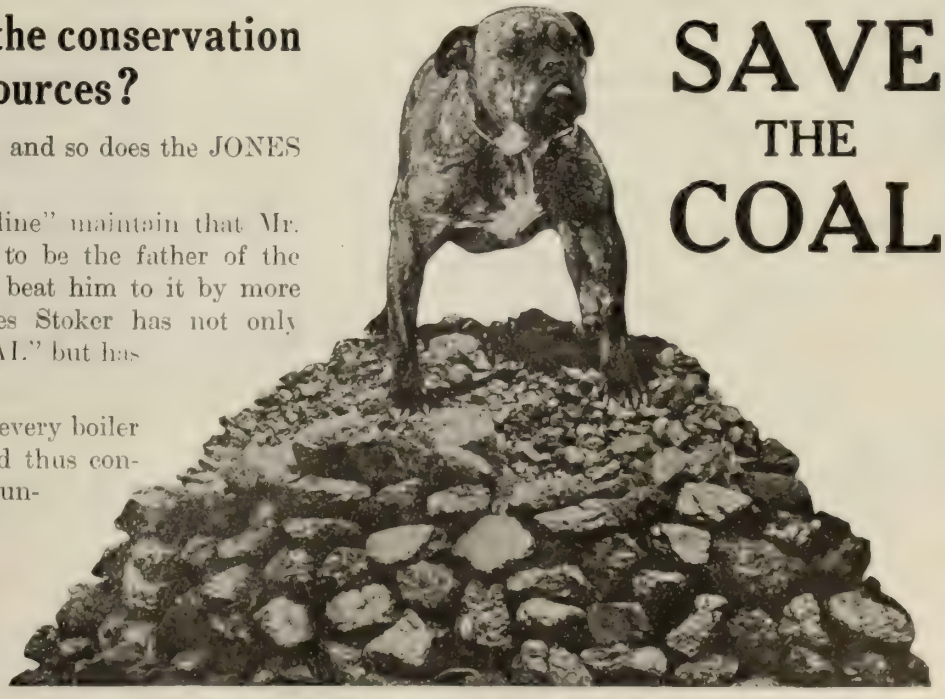
MURPHY IRON WORKS, DETROIT, MICH. BUFFALO, N. Y.

Do you believe in the conservation of our natural resources?

YES! We know you do, and so does the JONES STOKER.

Our friends "across the line" maintain that Mr. Theodore Roosevelt claims to be the father of the idea, but Mr. Jones Stoker beat him to it by more than ten years. Mr. Jones Stoker has not only preached "SAVE THE COAL" but has practiced what he preached.

Put a Jones Stoker under every boiler operating in your plant and thus conserve your own and your Country's resources!



SAVE THE COAL

THE JONES STOKER WATCHES OVER THE COAL PILE!

Jones Underfeed Stoker Co., Limited

NATIONAL TRUST BUILDING : TORONTO, ONTARIO

The advertiser would like to know where you saw his advertisement—tell him.

If You Require Cheap Steam Without Smoke Use

BENNIS Machine - Stokers and BENNIS Independent Elevators

Applicable to all Types of Boilers

"Bennis" U-link Chain Conveyor.

Fig. 3. The "Bennis" New Link Chain Grate.

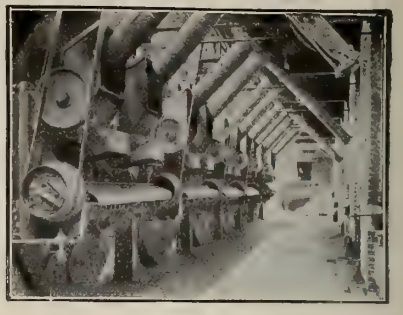


Fig. 2. The "Bennis" Coker.

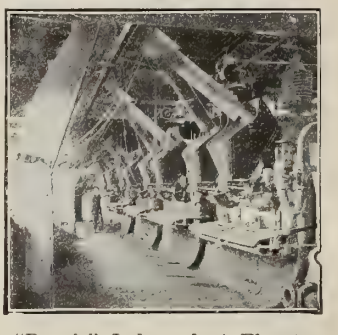
"Write for **Elevators" and Conveyors that Pay**" pamphlets to:

G. H. TOD

Manning Chambers
Queen Street West
TORONTO

Winnipeg; 601 Union Bank Building

Fig. 1. The "Bennis" Sprinkler.



"Bennis" Independent Elevators.

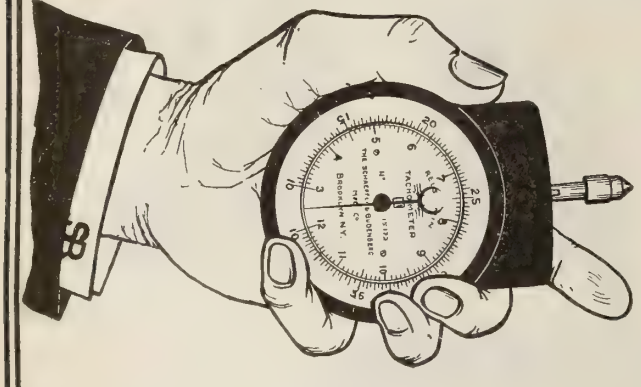
Write for **"Machine Stokers that Pay"** pamphlets to:

G. H. TOD

Manning Chambers
Queen Street West
TORONTO

Winnipeg; 601 Union Bank Building

The three leading types of "Bennis" machine stokers are here shown:—1. The "Bennis" Sprinkler. This machine is a powerful and rapid steam raiser, and is equal to heavy and variable loads. It burns low-grade fuels smokelessly. 2. The "Bennis" Coking Stoker. This machine keeps an intense fire with low-grade fuels, without smoke or grits, and is specially valuable in paper and pulp mills. 3. The "Bennis" New Link Chain Grate. This machine is fitted for use on water-tube boilers. Its close link of great strength renders it the finest chain grate on the market.



Have You a Tachometer?

If not, you ought to have one. You know what they are for, don't you? You know that the Tachometer is a solver of speed problems.

When the speed of a certain shafting, turbine, motor, machine or the like bothers you, a Stationery type of Tachometer is installed and your troubles are ended. When there are numerous different shaftings to be tested a Hand Tachometer is needed. And the best in hand tachometers is represented by our line of

S & B "Columbia" Tachometers

They are neatest, most compact and durable Hand Tachometers on the market. There are numerous styles for every purpose at varied prices. They possess important individual features not found in other types.

And we don't stop at hand tachometers, for we have a complete line of Stationary Indicating and Recording Tachometers for every conceivable purpose. All described in our Tachometer bulletin.

Write for Bulletin W 23—Now.

THE SCHAEFFER & BUDENBERG MFG. CO. 93

Chicago BROOKLYN, N. Y. Pittsburgh

The advertiser would like to know where you saw his advertisement—tell him.

It's the double construction that saves you money

Don't pay out good dollars year after year for rubber hose or ordinary flexible metallic hose that quickly kinks, blows out and goes to pieces. Save money, time and trouble by using

J-M Flexible Metallic Combination Hose

This hose gives better service for a longer time than any other hose on the market. It is virtually *two hose in one.* An inner lining of high grade rubber protected by a metal armor of remarkable flexibility and strength.

J-M Combination Hose can not be put out of service unless the armor is cut through. It will not kink, flatten or blow out; withstands a pull of 1,000 to 3,000 lbs., and a crushing strain of 300 to 800 lbs. to each four turns of its armor—according to size of hose. And it is positively pressure-tight under all conditions.

Most economical hose because heavy armor permits use of light inner tube which can be renewed at small cost.

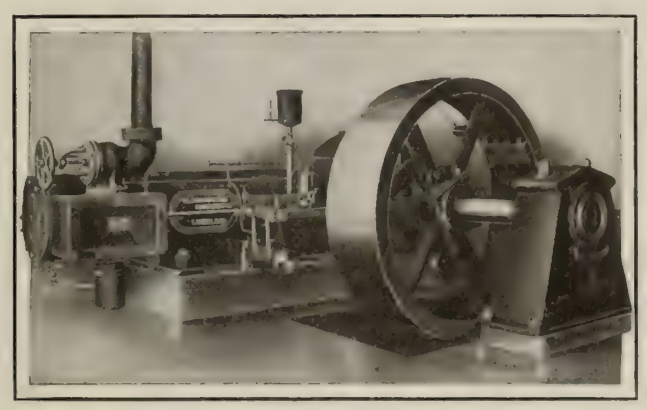
Write our nearest Branch for Booklet describing other desirable features.

THE CANADIAN H. W. JOHNS-MANVILLE CO., Limited

Manufacturers of Asbestos and Magnesia Products — TRADE ASBESTOS MARK — Asbestos Roofings, Packings, Electrical Supplies, Etc.

TORONTO MONTREAL WINNIPEG VANCOUVER

1973



Side Crank Leonard Automatic Engines

Particularly adapted for Direct Dynamo Connection and Electric Light Service. Made in Simple and Compound Units up to 500 Horse Power. For High Economy and Close Regulation this engine is unexcelled.

We also make High and Slow Speed Corliss Engines for Heavy Duty Service. Our "Tangye" Engine is very well and favorably known throughout Canada for Sawmill Work.

MADE BY

E. LEONARD & SONS, LONDON, ONTARIO

MANUFACTURERS OF

High and Slow Speed Engines of all kinds, Boilers, Heaters, Pumps, etc., etc., and complete Steam Plants.

WAREHOUSES AND AGENCIES AT

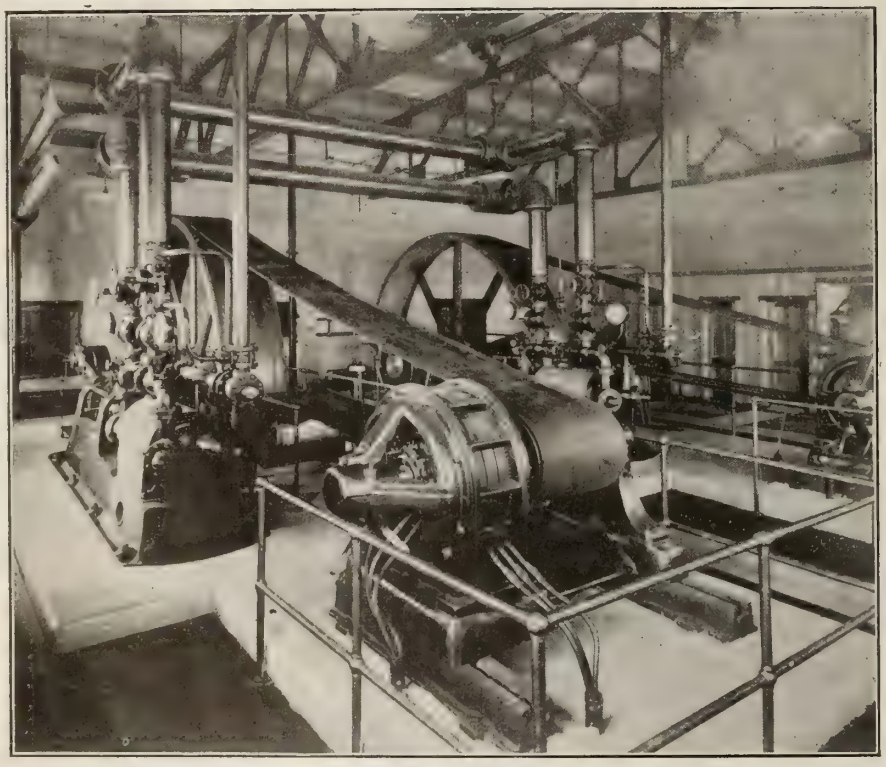
MONTREAL, ST. JOHN, N. B., CALGARY, WINNIPEG, VANCOUVER

"THE LINDE"

REFRIGERATING and ICE-MAKING MACHINERY

CORK INSULATION

Over 8,000 Machines in use. Established and Manufacturing in Canada for 16 years.



Two 100-ton "Linde" Belt Drivers, Double Acting, Horizontal Ammonia Compressors Manufactured and Installed by us in Canada.

Recent Orders:—

IMPERIAL BREWING CO., (3 orders), Kamloops, B.C.
WM. CLARK, LTD., Montreal, Que.
MR. J. A. PATRICK, New Westminster, B.C.
C.P.R. VANCOUVER HOTEL, Vancouver, B.C.
MATTHEWS-LAING, LTD., Fort William, Ont.
CARSON'S HYGIENIC DAIRY CO., Winnipeg, Man.
ST. THOMAS PACKING CO., St. Thomas, Ont.
MONTREAL GENERAL HOSPITAL, Montreal, P.Q.
OTTAWA UNIVERSITY, Ottawa, Ont.
WM. DAVIES CO., Winnipeg, Man.
CANADIAN NATIONAL EXHIBITION, Toronto, Ont.
McGILL UNIVERSITY, Montreal, P.Q.
G.T.P. FORT GARRY HOTEL, Winnipeg, Man.
C.P.R. ALGONQUIN HOTEL, St. Andrews, N.B.
AND MANY OTHERS.

The Linde Canadian Refrigeration Co.,

Limited

37 ST. PETER STREET, MONTREAL

Branch Offices—Toronto, Imperial Building, Adelaide St.; Winnipeg, 909½ Main Street; Vancouver, Anderson & Miskin, Imperial Block, Seymour and Pender Streets; Edmonton, Walker & Barnes, 562 Second Street; Calgary, General Supplies Limited, 1233 2nd Street East.

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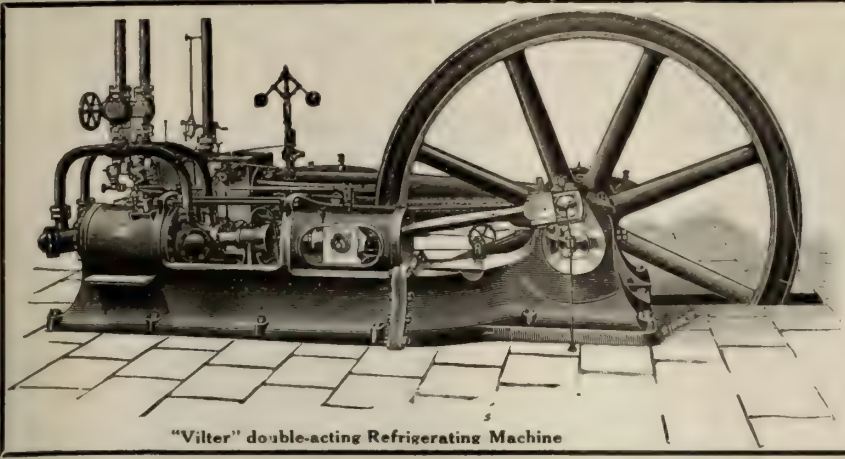

"Vilter" double-acting Refrigerating Machine

Established 1867

The VILTER MFG. CO.

242 Becher St. Milwaukee, Wis.

BUILDERS OF HIGH-GRADE

CORLISS ENGINES
ICE AND REFRIGERATING MACHINERY

any size and for any purpose, complete line Ammonia Fittings, Condensers, Brine Coolers, etc.

Write for Catalogue and full Particulars

The
LINDE BRITISH
Refrigeration Co. Limited

¶ Numerous fully authenticated laboratory tests organized from time to time in America and Europe, have invariably served to demonstrate in an unanswerable manner, the very remarkable degree of mechanical efficiency to which our products have been brought. *The history of mechanical refrigeration is our history.*

Head Office: LONDON, ENG.

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CANADIAN OFFICES
CORISTINE BLDG
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Self-Lubricating

In Cans
6, 12, 25 and 50 lbs.

SAFETY PLASTIC
METALLIC PACKING

LASTS FOR YEARS AND NEVER WEARS THE PISTON ROD.

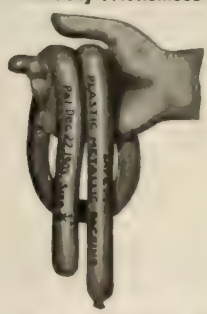
Guaranteed to stand steam temperature up to 550 degrees Fahr.
Guaranteed to stand hydraulic pressure to 5,000 pounds per square inch.
Packing furnished in bulk and in thin Cotton Tubes, sizes 3-16 to 1½ inch, 36 inches long, or in special lengths to fit your stuffing boxes.
Empty Cotton Tubing in assorted sizes FREE OF CHARGE with orders for the packing in bulk form.
The tubes are easily filled and they save you the expense of carrying a large stock of packings in different sizes.

Send for FREE SAMPLE and particulars.

Manufactured only by

STEEL MILL PACKING CO. WINDSOR, ONT.

Practically Frictionless



Sold on APPROVAL

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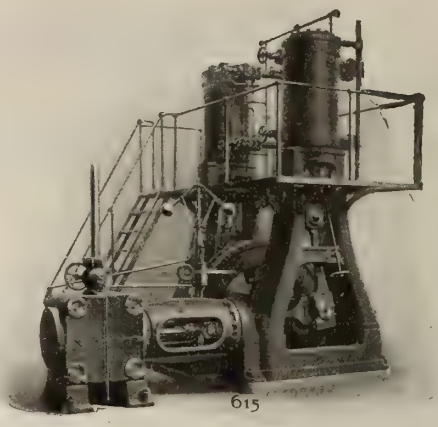
YORK MANUFACTURING CO.

LARGEST ICE MACHINE MANUFACTURERS IN THE WORLD

To Central Station Managers:



Why not utilize your surplus boiler capacity for making ice during light-load periods, and thus keep a practically constant load on your plant all the time? Have you considered how nicely these lines would supplement each other? Just as the demand for lighting purposes begins to fall off and gradually decreases, the demand for ice sets in and gradually increases, until the maximum of ice and the minimum for lighting is reached; then the reverse takes place until the minimum for ice and maximum for lighting coincide.

As our lines comprise all sizes and types of both the Compression and Absorption Systems, we are prepared to give you absolutely impartial and disinterested advice as to the system, and the type of machine, best adapted for your purpose.

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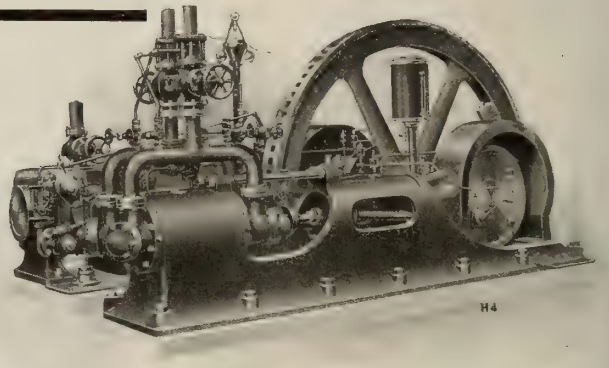
FRICK



Refrigerating and Ice-Making Machinery and Equipment

is acknowledged the world over to have attained the highest degree of efficiency. For thirty-three years FRICK Machines have successfully endured the wear of exhaustive tests and proven all guarantees made.

It will pay YOU to KNOW US.

The FRICK is the only machine of which it can be said "There is no better machine built." The FRICK is durable—efficient and will last a lifetime.

We build all types of Refrigerating Machines—Vertical Single-acting, Horizontal Double-acting and Absorption.

WRITE FOR CATALOGUE TO

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NEW YORK CHICAGO SEATTLE PITTSBURGH CLEVELAND LOS ANGELES
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THIS IS A CONTRACT

Looks Fair to Us. It is Fair

We invite users of Refrigerator Doors and Windows who are contemplating erection or remodeling plants to write us for

Sample Door and Frame Complete

We will forward it to size required. If it is not satisfactory from every standpoint to **you** in style, workmanship, efficiency and plan, it is your property without charge or any obligation to us whatever. We feel justified in making the above offer, to show our foreign friends our good faith. We have no Agents, either here or in your great country, to exhibit and present our products. In this proposition we hope to prove that we merit your confidence.

Our patronage in Canada is very large and general. A few of the largest sales are to:—

Linde Canadian Refrig. Co.	Montreal, Can.
P. Burns & Co.	Calgary, Alta.
Swift Canadian Co.	Toronto, Ont.
Whyte Packing Co.	Brockville, Can.
Moose Jaw Cold Storage Co.	Moose Jaw, Sask.
Standard Milk Co.	Vancouver, B.C.
Edmonton City Dairy Co.	Edmonton, Alta.
Canadian Fish & C. S. Co.	Prince Rupert, B.C.

Jones Cold Store Door Co.

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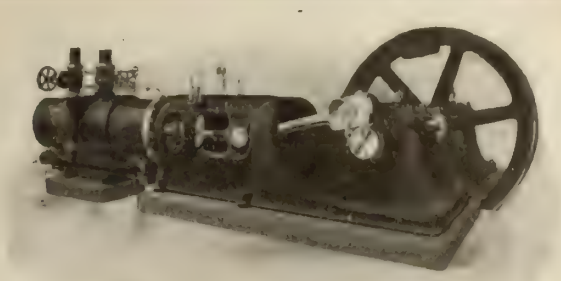


20% Over-Capacity

as compared with any other equal-sized horizontal ammonia compressor built today. This is our positive guarantee on the

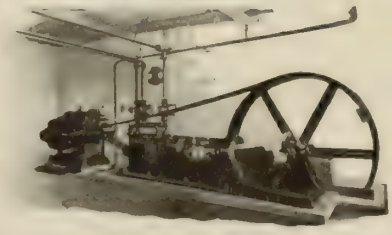
Arctic Ammonia Compressor

The area of suction valve is from 3 to 4 times larger than in any other ice machine — a mighty important advantage. Let us explain it to you.
Write for Bulletin 1-P.

THE ARCTIC ICE MACHINE CO.

CANTON, OHIO, U.S.A.

Ice and Refrigerating Machines



THE COMING AMMONIA COMPRESSOR

THE "SAFETY"

Built by

The HUETTEMAN & CRAMER CO.

DETROIT, MICH.

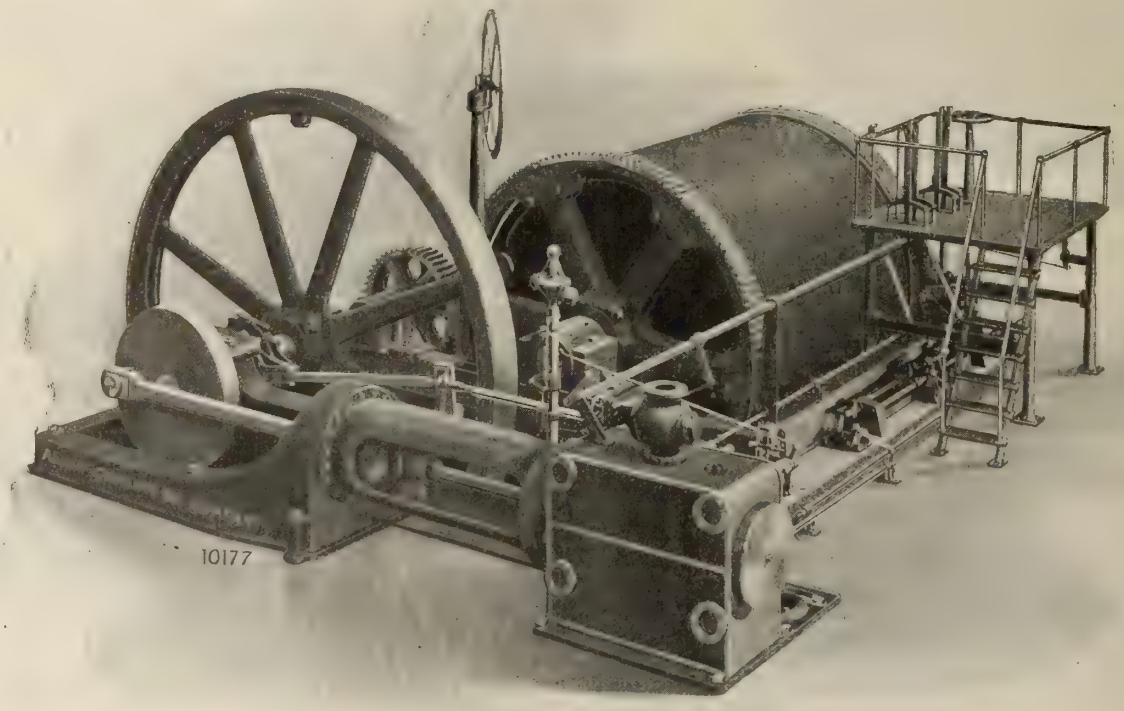
Complete Ice Making and Refrigerating Plants for every conceivable purpose.

SIX OF THESE "SAFETY" INSTALLATIONS TO DATE IN ONTARIO THIS SEASON

CORLISS HOISTING ENGINES

Built by engine builders and hoist builders of long experience and thoroughly familiar with field conditions. Allis-Chalmers Corliss Hoists can be depended on for the best economy in steam consumption, along with safety, simplicity and reliability.

No two hoisting problems are alike, and therefore the selection of a suitable Corliss Hoist requires experience and engineering knowledge. Our engineers are specialists in all matters pertaining to hoisting, and are at the disposal of those who have such problems to deal with.



24 x 28 Simplex Geared Corliss Hoist.

For a discussion of hoisting problems and descriptions of our different types of Corliss Hoisting Engines see

Bulletin 1803

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Head Office:—KING AND SIMCOE STS., TORONTO

DISTRICT SALES OFFICES:—

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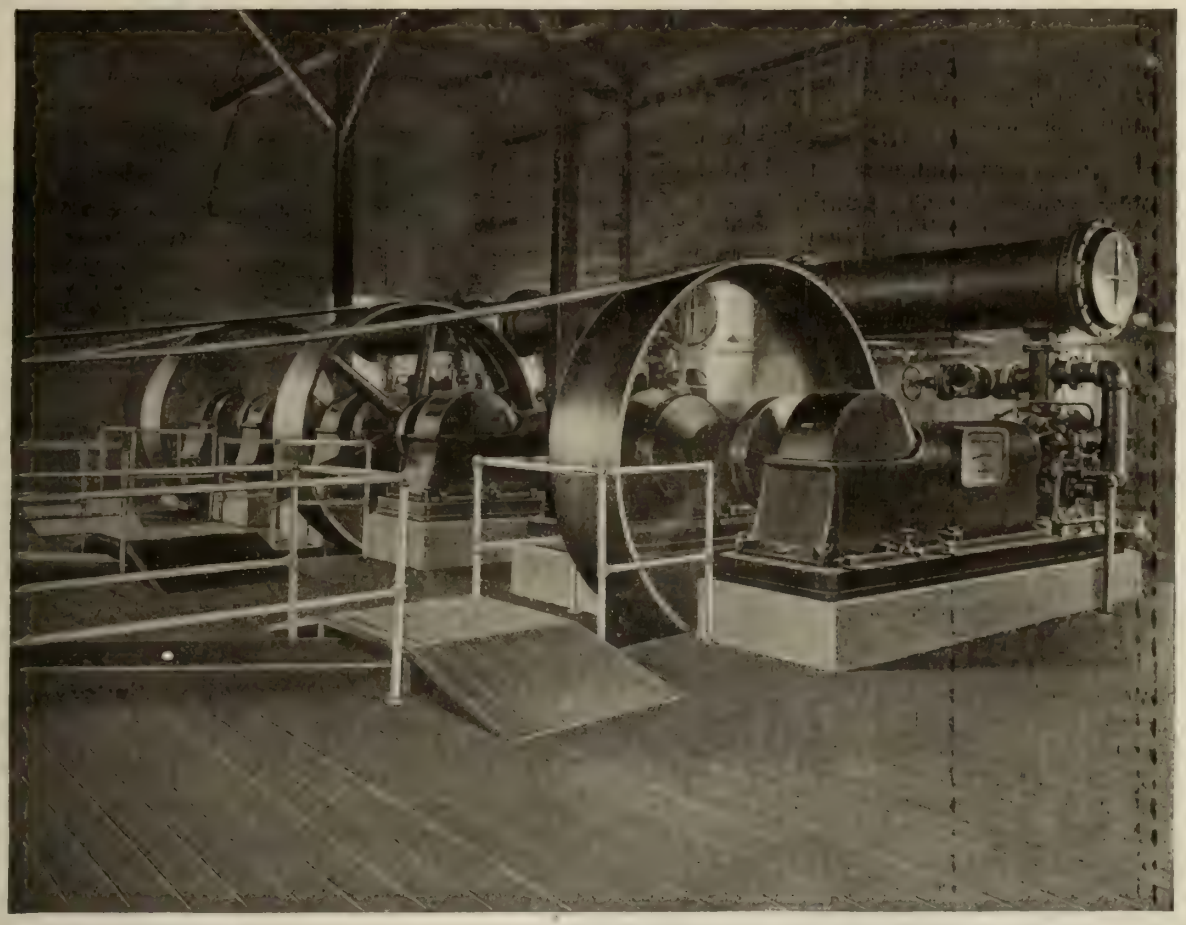
"BLAISDELL" AIR COMPRESSORS

For Power Plants in which continuous service is absolutely essential



THREE OF OUR DUPLEX BELTED COMPRESSORS

Installed at West Portal, Montreal Tunnel, by MacKenzie, Mann & Co., Limited

The compressors shown above are 22x14x18 with enclosed dust-proof frames, complete water-jacketed cylinder and heads, and large intercooling surfaces. The principal bearings are provided with flood lubrication, insuring freedom from trouble and absolute reliability of service. For further particulars see Bulletin 42.

CANADIAN ALLIS-CHALMERS

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WINNIPEG REGINA SASKATOON CALGARY EDMONTON
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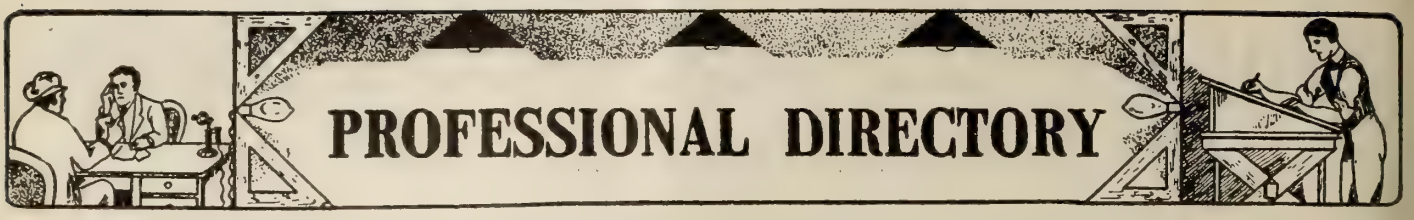

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Mechanical and Hydraulic Engineer
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ndicating, valve-setting and general repairs on all kinds of engines.
RENOWN ENGINE & MACHINE CO.
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Mechanical, steam, electrical and hydraulic engineering. Specialist on Automobile and Gasoline engines. Inspection, Appraisal.
NEW BIRKS BLDG. - MONTREAL.
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KENT BROTHERS
Miners and Exporters of
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MONTREAL CANADA

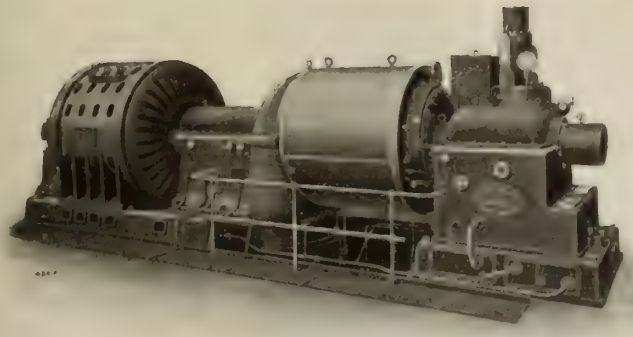
Bare and Insulated Electric Wire
Electric Light Line Wire. Incandescent or Flexible Cords.

Railway Feeder and Trolley Wire
Americanite, Magnite, Office and Annunciator Wire. Cables for Aerial and Underground Use.
HALIFAX TORONTO WINNIPEG VANCOUVER

STEAM TURBINES

of the

Belliss & Morcom Design



High Pressure Turbine with Alternator

In successful operation in many Power Plants, both in England and in the Colonies.

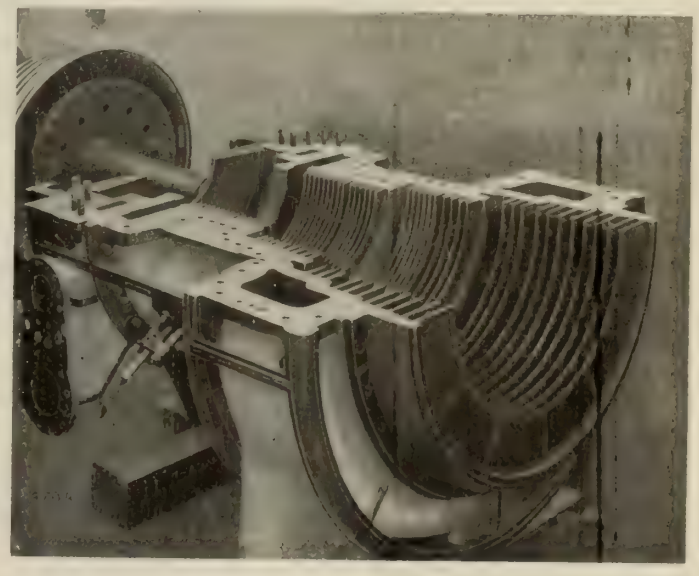
A 2000 K. W. High Pressure Turbine now in course of erection in the Power Plant of the Montreal Tramway Co., also a 2500 K.W. High Pressure Turbine being erected in the Municipal Power Plant of the City of Calgary.

Impulse principle adopted avoiding close clearances.

Drum construction adopted for rigidity. **Through Shaft** for perfect alignment.

Each Blade is held secure independently by a simple yet strong method. Guide blades secured in **rigid diaphragms** to give maximum protection from damage.

Governing and lubrication embody **long experience of lubricating and governing** High Speed Reciprocating Engines.



Projected View of Turbine Casing and Rotor

MANUFACTURED BY

Messrs. Belliss & Morcom Ltd., Birmingham, Eng.

AGENTS

LAURIE & LAMB

211-212 Board of Trade, MONTREAL

BAROMETRIC CONDENSERS

Although in steam engineering practice the condenser is as old as the engine itself, it has until very recently received far less consideration and has been treated as an auxiliary, the reliable working and efficiency of which had but little bearing upon the economy of the plant as a whole. With the advent of the steam turbine and the demand for higher economies, the importance of the condensing apparatus has become more clearly apparent, and it now holds its rightful place, as one of the principal parts of the steam plant.

Ret 5/21/15 JR

Many condenser installations are not satisfactory, and in some cases may be classed as absolute failures, because local conditions were not properly considered before the type and make of the apparatus were determined upon. We build condensers espeially dsigned to suit conditions existing at the placed where they are to be installed.

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., Limited

Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

Works: Seigneurs & Williams Streets, MONTREAL.

The advertiser would like to know where you saw his advertisement—tell him.

The First Sign of Decay

¶ A salesman who was more than a salesman was trying to sell his line to a certain manufacturer.

¶ "No," argued the latter, "I do not care to change. I am satisfied with the line I am now using."

¶ "That," replied the salesman, "is the first sign of decay!"

¶ It was a jolt for the manufacturer. It bumped him clean out of the rut of self-satisfaction, and set him thinking.

¶ It cranked the engine of progress that had stalled within him and set to work the rusty machinery of his ambition.

¶ The salesman secured his order and later received a letter profuse with thanks.

¶ Any man who is satisfied with his business as it is has entered upon a period of commercial decay.

¶ No matter how successful a business may be there is a legitimate twentieth century way of making it better.

¶ There is a vital force that can be injected into it—a regenerating force that will eradicate decay and replace it with the pulsing throb of increasing profits.

¶ That force is ADVERTISING. And advertising is never so forceful and effective as when it is undertaken in highly specialized mediums, of which this journal is so fine a type.

Why not throw in the forward clutch to-day and write for rate card and full particulars?

THE POWER HOUSE

A Monthly Publication Devoted to the Generation, Transmission and Application of Steam, Gas, Electric Air and Water Power.

143 University Avenue, TORONTO

G. & McC. VERTICAL QUICK REVOLUTION STEAM ENGINES

Will give you as they are giving others wherever installed

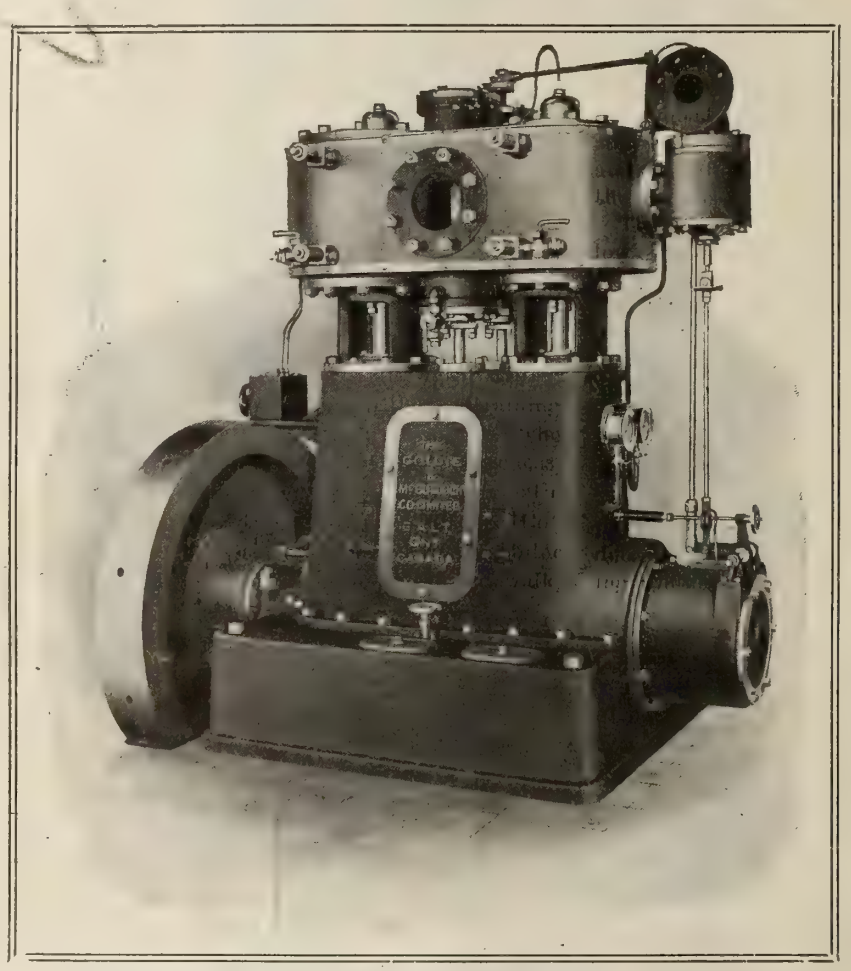
A MAXIMUM OF SERVICE

At a Minimum Cost of Upkeep

These Engines have a Perfect System of forced Lubrication.

They require little or no attention while running.

Built in all types and sizes.



They run with Practically no Noise or Vibration.

All working parts are very easy of Access.

Built to suit your Particular Requirements.

Two Cylinder Compound, Vertical Forced Lubrication, Quick Revolution Steam Engine, with Combined Throttle and Expansion Governor.

All the materials used in the Manufacture of Vertical, Quick Revolution Engines must be the best obtainable. In the construction of our Engines particular attention has been paid to this feature; the materials supplied being in accordance with **British Admiralty Specifications.** All Engines are tested under steam before leaving our works.

We shall be pleased to furnish Specifications and further information.

THE GOLDIE & McCULLOCH CO., LIMITED

Head Office and Works: GALT, ONTARIO, CANADA

Branches or Agencies:

TORONTO	MONTREAL, QUE.	WINNIPEG, MAN.	VANCOUVER, B.C.	ST. JOHN, N.B.
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Light, Heat and Power Equipment of a Toronto Bank Building

Staff Article

Steam continues to be a necessity of our civilization, and, in the realms of light, heat and power, it is well nigh indispensable. The disposition noticeable in recent years to supplant it is not now so much in evidence, and indications are that the near future will see it wooed instead of being spurned by its hydro-electric contemporary, and one time supposed infallible substitute.

THE new head office building which the Bank of Toronto have erected at the corner of King and Bay Streets, Toronto, is a handsome edifice, and one of the architectural features of the city. The building has an imposing appearance, and was designed by Carrere & Hastings, architects of New York, with whom is associated Mr. Eustace G. Bird, of Toronto.

Not the least interesting feature is the power plant installation, which is located in the sub-basement, it being an excellent example of an isloted plant, and no expense has been spared to make it complete in every respect. There being no natural light, special attention has been given to the illumination of this section of the building. The sub-basement is divided into four sections, containing, respectively, the engines and electrical apparatus, boilers and feed pumps, air washer, elevator blower and vacuum pumps. MacMullen, Riley & Durley were the consulting engineers, who were responsible for the layout of all the mechanical equipment.

Boiler Equipment.

The water tube boilers, three in number, are of the Erie city type, and were installed by the John Inglis Co., Toronto. They are arranged in two batteries, single and double, the total heating surface being 4,035 square feet. Each boiler has a steam and water drum, 3 ft. 6 in. diameter by 6 ft. 7 in. long, and consists of eight sections, each section having nine 4 in. tubes 16 ft. long. The working pressure is 160 lbs. per square inch. Each boiler is suspended at the front and rear from a wrought iron frame entirely independent of the setting, to allow for expansion and contraction without straining either the boiler or brickwork. The boilers have "Dutch Oven" furnaces, to which have been fitted automatic stokers by the McKenzie Furnace Co., Chicago. Coal is delivered to the boiler room through a chute in the sidewalk, and is carried to the furnace by a one-ton Sprague electric hoist suspended from an overhead track. The draft is controlled by a "Climax" damper regulator. The boiler feed is taken care of by two 6 in. x 4 in. x 6 in. duplex steam pumps furnished by the Canada Foundry Co., Toronto, these operating in connection with a Webster heated, supplied by Darling Bros., Montreal, and to which the exhaust steam from the engines and auxiliaries is carried.

The boiler room floor level being below the sewer, two vertical automatic sump pumps, by the Yeomans Electric Co., Chicago, have been installed. These are each operated by a 3 h.p. motor, and take care of the low level drains and water from the baffle tank into which the boilers are blown off. There is also an hydraulic ash hoist, which was supplied by the Otis-Fenson Co., Toronto. The boiler room is kept comparatively cool by 4 ventilators, which deliver cool air from the main ventilating system, and a lavatory and shower

NEW BANK OF TORONTO, KING AND BAY STREETS, TORONTO, ONT

have been provided for the benefit of the firemen.

The high pressure steam piping is steel with Van Stone joints, and was furnished by the Crane Co., Chicago. It is covered with an 80 per cent. magnesia compound, wrapped with stout canvas and painted. This part of the installation was carried out by Bennett & Wright, Ltd., Toronto. The steam lines supplying the engines are in duplicate, and are so arranged that if one line goes out of commission the other can be put into service without delay. The two steam pipes from the boiler room are connected to a header in the engine room, from which the 4-inch and 3-inch steam pipes to the engines are taken. A valve for each branch is fitted in the header. The exhaust steam can be controlled by two valves located in the boiler room, in addition to those under the engine room, access to which is obtained through a movable panel in the engine room floor. The main exhaust pipe, 10 in. diameter, is taken up through the building to the roof, where a Crane exhaust head is fitted. A connection is made with the feed water heater through a Webster oil separator to the exhaust pipe.

The waste gases discharge into steel plate breechings located at the rear of the boilers, and are conveyed to a steel stack with an outlet at the top of the building.

Generating Equipment.

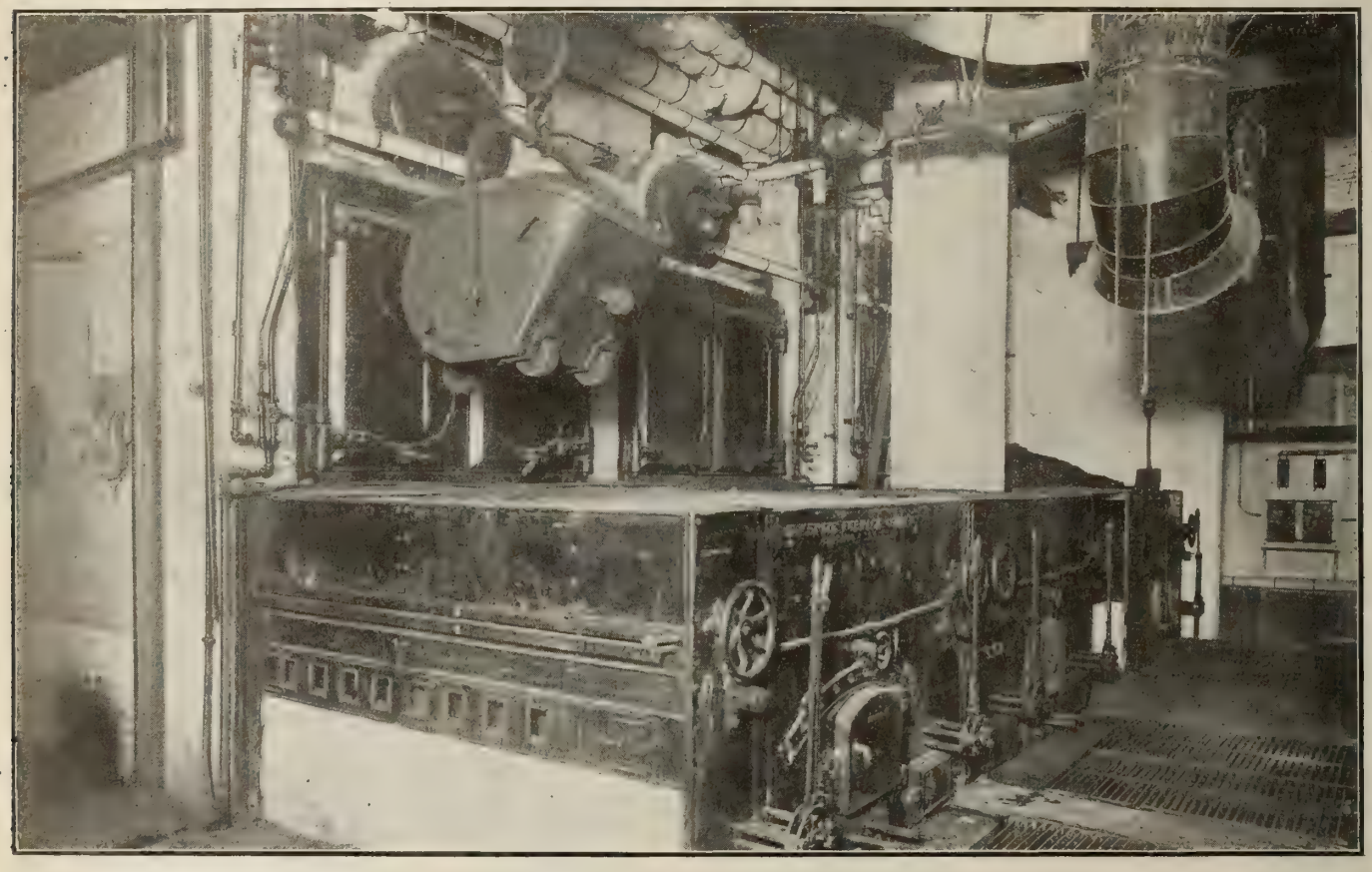
The engine room is well illuminated, the walls being of white glazed brick, and the floor of red tile. There is ample room for the generating equipment which consists of 4 Robb-Armstrong horizontal, side crank engines direct connected to Canadian General Electric generators. Two of these sets are 13 in. x 14 in. engines, the generators being 75 K.W., 275 R.P.M., 125|250 volts, D.C. The other two sets are 9 in. x 10 in. engines, the generators being 25 K.W., 310 R.P.M., 125|250 volts, D.C. The working steam pressure is 150 lbs. Three wire, 125 volt generators take care of the lighting circuit, while 250 volts is employed on the motors. The gauge board is of marble, 36 in. x 45 in., and has the following gauges: Three 10 in., one from each boiler, for high pressure gauges; one 10 in. back pressure gauge one 10 in. Thomas clock; one Morrison pressure recording gauge; and one high and low pressure alarm gauge with alarm set to ring at 160 lbs.

The switchboard, which is 15 feet long, is made of grey marble slab 1½ inches thick, and has the following instruments: Two Weston volt meters; 8 Weston ammeters; 2 recording Duncan watt hour meters and I.T.E. circuit breakers. This installation was carried out by the Harry Alexander Co., of New York and Toronto, under the supervision of Mr. J. M. Lindsay.

In the engine room, and adjoining the main switchboard, is a 20 volt Crocker-Wheeler motor generator set for charging the batteries used for the telephone service, electric clocks, etc. In connection with this, is a small switchboard having a Weston volt meter and ammeter, also a Cutler-hammer rheostat. The electric clocks, of which there are seventeen, are controlled by a master clock located in the dining room on the top floor. These clocks were supplied by the Howard Clock Co., New York.

Heating and Ventilating Equipment.

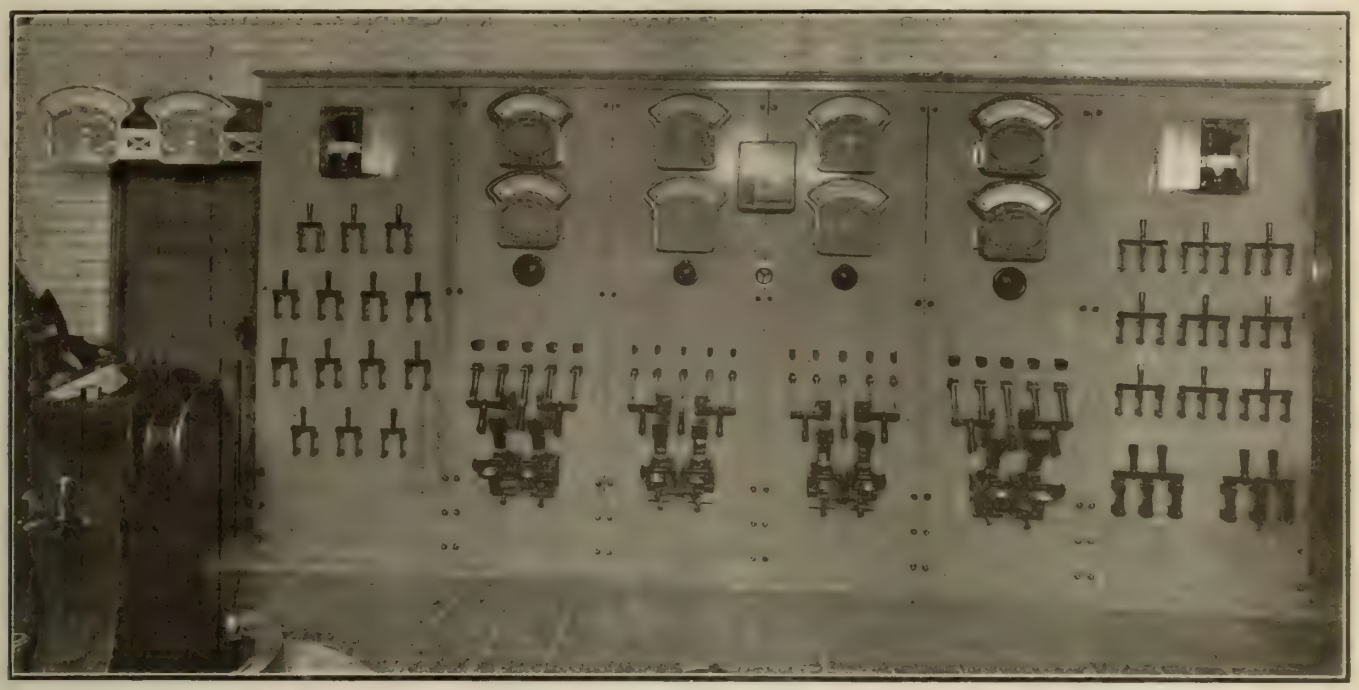
Adjoining the boiler room is the air washer and heater. The air washer has a capacity of 50,000 cubic feet per minute and was installed by the Carrier Air Conditioning Co., of New York. It consists of a series of water sprays and eliminators, through which the air is drawn and washed, the eliminators being made of No. 24 gauge Toncan metal. There are two Vento cast iron hot blast heaters with a total heating surface of 4928 sq. ft. These are arranged so that the air passes through one set before being washed, and through the other set after being washed. The washer casing is made of No. 18 gauge galvanized Toncan metal, while the settling tank is also made of the same material, 16 in. deep. The inspection door at the side is fitted with a glass panel. An automatic float valve is provided for main-



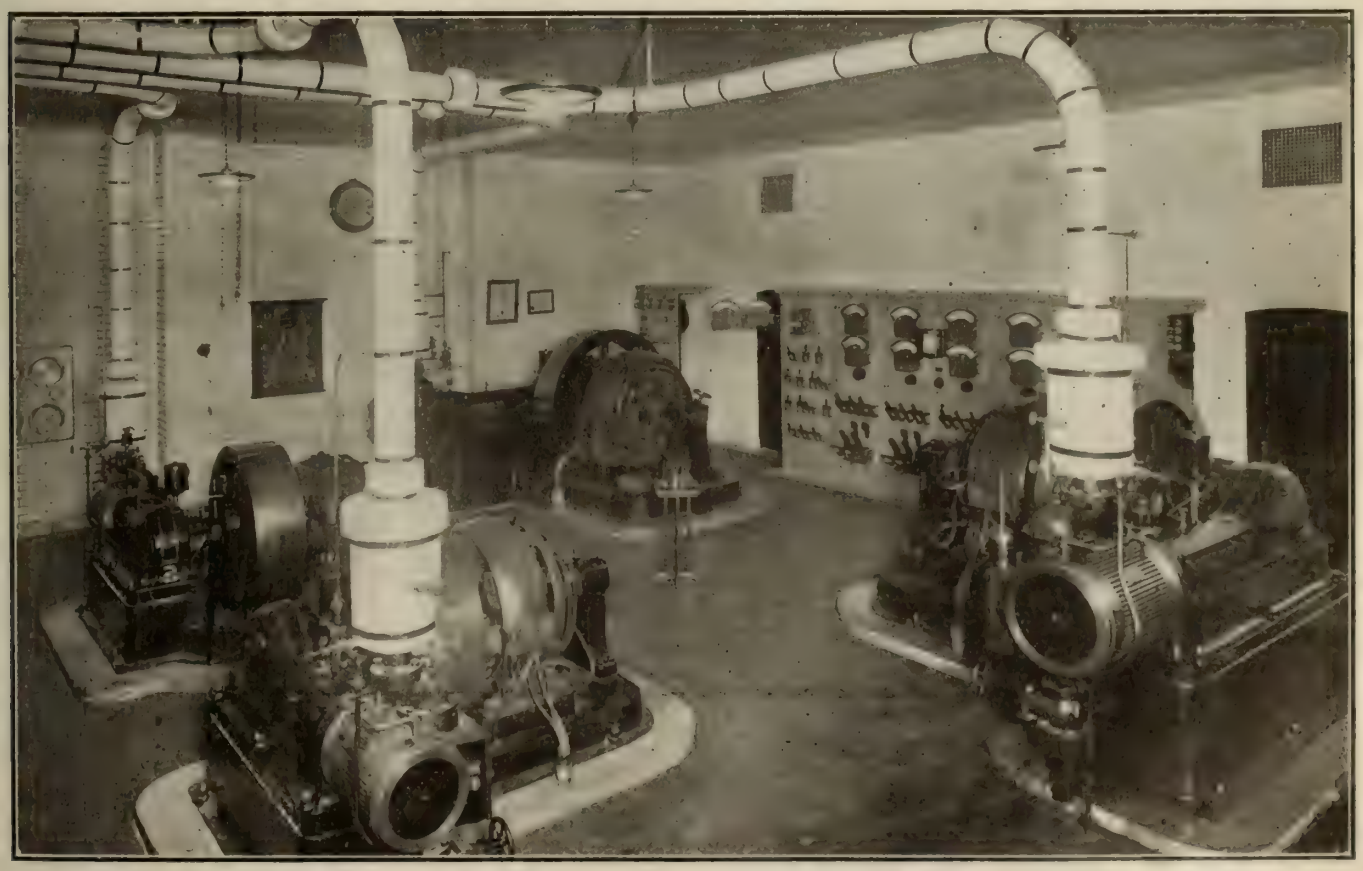
BOILER ROOM, BANK OF TORONTO POWER PLANT.

taining a constant water level. There are also two strainers made of No. 24 gauge copper screen, for straining the re-circulated water; one is located on the suction line of the pump and the other on the discharge line. A 2½ inch Buffalo Pump Co., centrifugal pump driven by a 7½ H.P. Canadian General Electric motor provides water for the sprays. There is a humidity control and also a thermostat control which operates, by means of compressed air, diaphragms located on the steam pipe line supplying the heaters. The compressed air for this service is furnished by a motor-driven compressor supplied and installed by the Johnson Service Co., Milwaukee. The thermostat control devices fitted throughout the building were installed and furnished by the same firm.

In operation, the air is drawn through the heaters and washer by two Sheldon fans, each operated by a 10 H.P. Bruce Peebles motor located in the sub-basement; the air being delivered through ducts, installed throughout the building,



MAIN SWITCHBOARD, BANK OF TORONTO POWER PLANT.



ENGINE ROOM, BANK OF TORONTO POWER PLANT.

with the exception of the top floor, where steam heat is provided. A Sheldon motor-driven fan located on the roof extracts the air from, or returns it through the building again if necessary. Another fan on the roof ventilates the lavatories, being a separate system. Each room is provided with a thermostat by which it is possible to regulate the temperature to any desired degree. On the top floor the thermostat acts on a diaphram fitted to each radiator, while on the other floors, the thermostat operates a damper in the ducts. Compressed air is used for operating the diaphrams.

The Webster system of circulation is installed for steam heating on the top floor. In connection with this system, are two vacuum pumps located in the sub-basement, one 10-in. x 12-in., being driven by a Bruce Peebles' motor, and one 8-in. x 10-in. x 12-in., by steam. The pumps draw tthe condensations from the radiators and the "Vent" heaters, and deliver into an air separating tank 72 in. x 26 in. upon which drains into the feed water heater. Exhaust steam is used for heating the radiators.

PNEUMATIC TUBE SYSTEM.

A pneumatic tube system operating from a central station, in which the telephone exchange is located, has been installed. Compressed air for this service is furnished by a Connersville horizontal rotary blower, located in the sub-basement, with a capacity of 13 feet of air per revolution and driven by a C.G.E. 10 H.P., 400 R.P.M. motor. There are twenty-three stations located in the building. This installation was carried out by the Lamson Consolidated Store Service Co., Boston, Mass.

Vacuum Cleaner System.

A vacuum cleaner system is installed throughout the building, and was supplied by the Spencer Turbine Cleaner Co., Hartford, and installed by Bennet & Wright, Toronto. The turbine is located in the sub-basement, and is operated by a 7½ h.p. C.G.E. motor. It is so arranged that the motor can be started or stopped by switches located at various points in the building.

The water for drinking purposes is well filtered. The water first passes through two filters in the basement; it then rises to the top floor where it is again filtered, sterilized and cooled. It is then pumped to the drinking fountains located throughout the building. The water supply for service purposes is a separate installation.

Elevator Equipment.

The elevator equipment was installed by the Otis-Fensom Elevator Co., and consists of three passenger elevators, one freight elevator, two dumbwaiters and a pumping plant. There is one hydraulic plunger passenger elevator close by the main entrance on King Street, which runs from the ground floor to the first floor. It has a capacity of 2,000 pounds and a speed of 250 ft. per minute with a load of 1,200.

There is a hydraulic plunger passenger elevator near by the Bay Street entrance which runs from the basement to the top floor. This unit has a capacity of 2,200 pounds, and a speed of 300 ft. per minute with a load of 1,200 pounds. Close by the vault there is an automatic push button elevator, which runs from the main floor to the first floor, and has a capacity of 1,500 pounds, and a speed of 150 feet per minute with a load of 1,500 pounds. The freight elevator is of the hydraulic plunger type and travels from the sub-basement to the street level.

There are two dumbwaiters, one being used for the service work, and the other machine for a booklift. Both of these machines are of the full automatic type which can be called at, and sent from any floor. They are operated by 7½ H.P. electric motors. The pumping plant of the hydraulic elevator consists of two Worthington duplex, tandem, steam pumps, 12 in. x 10½ in. x 10 in., located in the sub-basement. Water is pumped into a pressure tank at 150 lbs. from which the elevators are operated. The discharge tank is also located in the sub-basement.

The ornamental iron work of the dome and other portions of the building was fabricated and installed by the Ornamental Bronze and Iron Works of the Canadian General Electric Co., Limited.

Lighting Feature.

The lighting fixtures supplied and installed by The Murray-Kay Co., of Toronto, are of very artistic design and present a handsome appearance. On the entrance to the vestibule are two six-light standards which are of solid bronze, the detail on the shaft being hand chased. The main banking room is lighted by four 60-light electroliers. These are also very handsome fixtures of the semi-direct lighting type, the metal work being of bronze and the bowl of alabastine imported from Italy. The mezzanine floor is lighted by eighteen 6-light ceiling fixtures, having alabaster bowls and being finished in gold. The private offices and assembly room are lighted by 5-light bronze fixtures. In the engine room there are six 5-light, semi-indirect fixtures. "Sunbeam" tungsten lamps are installed throughout the building.

Don't be content with doing only your duty. Do more than your duty. It's the horse who finishes a neck ahead who wins the race.

SARNIA WATERWORKS.

IN connection with the recent ceremony of turning the first sod for considerable extensions to the waterworks of the town of Sarnia, Ont., it is interesting to note that the Waterworks Commission have finally decided to install steam turbine-driven pumps, after having spent considerable time in investigating all other types, including the vertical high duty type of pumping engine.

The available speed of the pump is 1,500 r.p.m., this being fixed by the fact that at some future time it may be required to connect the pump to an electric motor to operate on the Hydro-Electric 25-cycle supply. Herringbone gears are to be used to connect the pumps to steam turbines operating at 3,600 r.p.m. By using this speed for the steam turbine, about 20 per cent. less fuel will be consumed than if the turbines were run at the same speed as the pumps. "Herringbone" type gears have been successfully employed for powers sufficiently large to drive steamships, are entirely enclosed in a cast iron casing, and are practically noiseless. There are two similar units to be installed.

The pumps are of the well-known Mather & Platt single stage turbine type, each capable of delivering 3,000 Imperial gallons per minute against 200 feet head, and the complete contract has been placed in the hands of the Canadian Allis-Chalmers, Ltd. The various units will be manufactured at their Montreal works.

EFFICIENT WORKSHOP LIGHTING.

IN a paper read before the American Institute of Electrical Engineers, Mr. C. L. Eshleman gives some figures showing the value of efficient workshop lighting. Regarding his personal experience as a workman, he found that his output on piecework when on night shift was only 55 per cent. of his output when working on the day shift on like work. Other mechanics noted, showed similar results. Further, among electrical field coils wound by the night shift, from 10 to 15 per cent. failed to pass the insulation test, whereas only 5 per cent. of those made by the day shift failed. Possibly lighting was not the only factor involved in these striking cases, and, may be, the illumination at night was unusually bad. Even allowing for these influences, the results indicate that efficient workshop lighting increases the output and improves the quality of the work done—two gains of great importance to employers and employed alike.

Auxiliary Steam Stations for Hydro-Electric Plants*

By R. C. Muir **

The question of auxiliary steam plants is at the present time a live one in many of the industrial centres of Ontario, where hydro-electric power has been playing fast and loose with its service to consumers. The whole subject is of broad general interest, and the treatment as given in this article, is such as to contribute to its more intelligent appreciation.

STEAM power plants held in reserve for, or operated in conjunction, with Hydro-Electric plants are commonly called auxiliary steam stations. The subject is one which is so general, and still the application is so special in each individual case, that it is impossible to cover all details in one short article. There are certain fundamental principals involved in the building and operation of all auxiliary steam stations, however, which may be briefly set forth in this paper.

Function of Auxiliary Steam Station.

The function of the auxiliary steam station depends principally upon the Hydro-Electric development, the load and the nature of the load, and may be any one or a combination of any of the following:

1.—To be held as an emergency reserve to take over the load in case of a breakdown in the Hydro-Electric plant or transmission line.

2.—To be held in reserve for periods of low-water or insufficient water supply.

3.—To be held in reserve for peak load periods.

4.—To be operated continuously in conjunction with the Hydro-Electric plant.

Emergency Reserve.

In this case, the steam power plant is purely an insurance against interruptions of service; and its adoption or maintenance may be the result of contract requirements of a Hydro-Electric development and transmission system, where the loss in revenue, due to interruptions, would exceed the cost involved in the installation and operation of the steam auxiliary.

Size.

The size of the auxiliary steam station depends upon the nature of the load. The load on any system can usually be divided into two or more classes. With one class, such as the lighting and railway load in the business district of a city, it is practically imperative that there be no interruptions with the other class, such as industrial load and resident district load, interruptions are not considered to be so serious. In case it is desired to provide against interruptions of service in the first class only, the auxiliary steam station must be of sufficient capacity to take care of only this load; but if it is desired to provide against interruptions in both classes, the auxiliary steam station must be equal in capacity to the Hydro-Electric plant.

Location.

The location of the steam plant should be at the receiving end of the transmission line, or, as near to the point of consumption as is possible to obtain favorable site with regard to cost of real estate, condensing water and shipping facilities. The type and construction of the steam auxliary station are influenced by the initial cost, the cost of labor and the efficiency of the apparatus.

Initial Cost.

The initial cost should be kept as low as possible, as the fixed charge is the largest item in the expense involved. In order to keep the initial cost down, the site should be low in first cost, and such that the development involved for condensing water intake and discharge will be inexpensive. The construction of the building should be simple. The prime movers should be steam turbines of as large capacity as feasible, and steam boilers should be of the water-tube type of fairly large capacity. Large units will also keep the cost of labor down, and will tend to make a simpler and more easily operated plant. The layout of the apparatus should be given special consideration with respect to the operation of the plant with the fewest possible men.

Efficiency.

Efficiency is of the least importance; but, with large steam turbine units, it is practical to obtain the most efficient unit at practically the same cost as one of poorer efficiency. The more efficient the steam turbine, the less the boiler capacity required. Consequently, a plant of high efficiency can be built at practically the same cost as one of lower efficiency.

Boiler Readiness.

It is not customary in auxiliary steam plants to have the boilers under steam and in readiness to take over the load immediately an interruption occurs. In some cases, it may be desirable to keep part of the boilers under steam, to take over a certain part of the load; and in these cases it is often advisable to keep the steam turbines running light as synchronous condensers, with just sufficient steam entering to make up for the no-load losses. Means should be provided to get the boilers under steam with the least possible delay. In districts where crude oil is usually used for fuel this can be readily accomplished with the oil-fired boiler, while in other districts fuel oil can be used until the coal fires can get under way.

New Hydro-Electric developments are often subject to interruptions for a short time; but the faults are soon corrected, the operating force becomes familiar with the operation and therefore more efficient, the interruptions become less frequent, and the water power grows in favor with the consumer. In most cases steam plants fortunately precede the Hydro-Electric plant and can be held in reserve to take care of these interruptions. As the water power grows in favor and the load increases, the steam plant is not usually increased in proportion, and consequently is not a complete reserve. Occasionally, the consumer has a steam plant which he used up to the time of purchasing energy from the power company. This can be held as a reserve and possibly an exchange agreement effected, whereby the power company can use the customer's steam station during interruptions or periods of low water.

In the opinion of many, the modern Hydro-Electric plant and transmission system designed and built by competent engineers and contractors is as reliable, or practically so, as the steam power plant. We, therefore, seldom find a steam auxiliary station held in readiness to take over the entire load in case of an interruption to the Hydro-Electric plant.

Reserve for Periods of Low Water.

The wide variations in stream flow during different times of the year is the most serious problem that confronts the water power concern. This irregularity in stream flow can be partly met in many cases by water storage. Enough storage capacity can usually be provided in Hydro-Electric developments to ensure that fluctuations in the 24-hour load can be taken care of, even

*General Electric Review.
**Power and Mining Engineering Dept., G.E. Co.

though the peak load is somewhat in excess of the power corresponding to the minimum stream flow. Of course, the average or intergated load over the 24-hour period must be within the energy available from the minimum stream flow. Without water storage, the minimum flow determines the maximum power that can be developed the year around.

It is customary to develop a water power somewhat beyond the capacity corresponding to minimum stream flow, the deficiency being made up by an auxiliary stream plant. Before a decision is made as to the size of the hydraulic plant, the stream flow for many years should be thoroughly investigated.

It is usually considered good practice to install a water power plant of such a size that it can be operated at full capacity approximately 60 per cent. of the year. The economic development may be somewhat higher than this in some cases, especially where the expense involved in installing additional generating units is small compared with the total investment. The size of the auxiliary steam station is determined by the difference between the demand curve and the stream flow curve, except where storage or pondage is available; then the stream flow as affected by such pondage or storage should be used.

Economy Feature.

The same remarks that are given under "Emergency Reserve" regarding location and type of plant apply in this case. Economy is, however, somewhat more important, so that a little more attention should be given to this feature.

The method of operation of a steam auxiliary station in connection with a Hydro-Electric station deserves careful consideration. Two things are particularly important—economy of operation and peak load. In order to get the best economy out of the steam station, it must operate at practically a constant load corresponding to full load on one or more units. In order to get the best economy out of the water power station with the water available during low water periods, the highest water level attainable—in other words the maximum head—must be maintained at all times.

It is impossible to conform to both of these requirements, especially where the minimum stream flow capacity and the steam station capacity combined are not sufficient to carry the peak load. In this case, the steam plant can be operated at practically a constant load, using the water power during the peaks and storing water during the balance of the time.

With high head plants, the head gained by storage is not of importance; so that the steam plant can be operated most economically on constant load, allowing the water power to take the peaks. With low head plants having considerable storage capacity, both plants can be operated advantageously during the low water period. Here, again, the water power should carry the peaks, and the steam plant should be operated at constant load over a sufficient part of the day so that the water level will not be materially affected. This method of operation will prove much more economical, both as regards fuel used and labor required, than the method of carrying heavy loads on the steam plant during the peaks, thereby requiring more boilers and machines in service and consequently more fuel and operators.

Peaks.

The term "peaks" is intended to cover heavy load periods of the daily load curve, and not the momentary load fluctuations. Assuming equal governor or speed regulations, and equal flywheel effects, these momentary load fluctuations are divided between the stations in proportion to the total capacities of the generators operating in each station. The flywheel effect of the steam turbine is usually the larger, and the steam turbine governor is the more sensitive. The steam turbine station will, therefore, ordinarily take more of the momentary fluctuation than its proportionate capacity in operation.

Fuel Economy.

Some fuel can be saved in developments of this kind by carefully observing the rainfall within the drainage area of the stream developed. In case of rainfall within this area, the steam plant can be shut down immediately, and all the load taken over by the hydraulic plant at the expense of reducing the level of the reservoir. The increased stream flow will again fill the reservoir. Rainfall at the head waters of a large stream would not materially increase the stream flow at the development of some time; and consequently a considerable saving in fuel would thus be effected.

During the dry season, water flowing over the dam means fuel wasted; and, therefore, if enough reliance could be placed in weather forecasts to anticipate rainfalls, the steam plant could be shut down in time, so that the reservoir level would be reduced sufficently to take care of the increased flow without wasting any more over the dam than necessary.

Reserve for Peak Loads.

There are two conditions which make it necessary or advisable to install auxiliary steam stations for peak load reserve:

(a)—When the water power development is not of sufficient size to carry the peak loads.

(b)—When electrical energy is being purchased on the maximum-yearly-demand basis, and the load is such that a heavy peak load is experienced only for a short period each year. This applies particularly to lighting or railway companies whose winter peak loads are very heavy, and of short duration. In this case, it is sometimes cheaper to operate a steam plant during the peak periods than to pay for energy for the entire year on the basis of the peak, which only exists a short time each year.

In either of these cases, the steam plant should be located at the receiving end of the line. Its size should be sufficient to take care of the difference between the peak and the size of the water power plant in the first case; and the difference between the peak and the average load demand in the second case. The steam plant should contain the fewest possible number of units, in order to make it inexpensive as regards first cost and operation. Economy is of practically no importance on account of the short period of operation. The design and care of the station and apparatus should be such that the depreciation during idleness will be a minimum.

Continuously Operated Steam Plants.

Where the average power demand exceeds the capacity of the Hydro-Electric plant, the steam auxiliary must be operated continuously. The location of the plant, as with previous cases considered, should be as near the load as consistent with a favorable site. If the load demand is such that the size of the steam plant is necessarily large in comparison with the water power plant, it would be advisable to make it of sufficient size to take care of the entire load in emergency cases. The size of the units should be determined from the load curve, in order that most efficient operation could be carried out. Economy is of importance and requires careful consideration. Both plants should be operated so as to obtain maximum efficiency from each; and the remarks regarding operation under the second case considered, viz., reserve for low water periods, apply to this case also.

From the foregoing remarks it is evident that each individual water power development presents a different problem, which requires special consideration before the proper auxiliary steam station can be decided upon.

Educating the Public in Methods of Preventing Smoke

By O. Monnett*

The problem of "How to deal with the Smoke Nuisance" is one in which manufacturers and corporations are intensely interested. Careful note should be made of the satisfactory solution arrived at by the City of Chicago, the details of which form the subject matter of this article.

THE Chicago Smoke Department has adopted a policy of educating the public in methods of preventing smoke. Plant owners, engineers, and firemen are instructed as to the best way of utilizing the equipment they have, and are advised of the proper method of furnace construction adaptable to their conditions. For this educational work the Smoke Department has a number of expert engineers.

Mode of Procedure.

The problem of each plant which violates the law by emitting dense smoke, is carefully investigated and thoroughly considered by the engineers of the Department, before recommendations or suggestions are made to the owner as to the best way to handle his plant, or as to the reconstruction work necessary, so that he may operate with a minimum amount of smoke. Many times, entire boiler plants are rebuilt in order to stop the smoke, and often furnaces are reconstructed throughout. It sometimes happens that, after a new plant is put in operation, it smokes, and the operating crew find it difficult to run without making making the latter objectionable. The Smoke Department gives a plant special attention, and keeps in close touch with the work until the cause of the trouble is definitely known, and changes made that will rectify matters. In some cases, builders purposely use inferior material and make poor installations. When the Department learns of such, special effort is made to have the work of doubtful merit improved upon, and in a number of instances, further work on a plant has been stopped until certain objectionable features have been removed.

Automatic Stokers.

There are many good boilers and furnaces on the market to-day, and, the problem is to have the furnace and boiler arrangements such as to get the best results. There are no furnaces built that will work satisfactorily in all places, because of the great variations in the characteristics of different plants. The majority of furnaces installed in Chicago since the organization of the present Smoke Department have been designed specially for the plants in which they are used. It is the aim of the Department to get automatic stokers in all plants that are large enough to warrant the expenditure, for so long as furnaces are hand fired, there will be trouble in keeping the smoke down, because so much depends upon the conscientious effort of the operators. There are surprisingly few hand-fired furnaces on the market that can utilize Middle Western coals, even though proper draft facilities are provided and average eare in operation is used, without producing considerable objectionable smoke. It is interesting, though, to note that most of the furnaces which can comply with these requirements are not patented.

The Operation Feature.

It has been the experience of the Department that practically every mechanical stoker on the market to-day can be applied to boilers under circumstances which will allow it to run satisfactorily from a smoke standpoint. There have been developed, and are in extensive use in Chicago, various designs of hand fired furnaces for utilizing coal, wood refuse, etc., that are adaptable to horizontal return tubular or water tube boilers. However, it is a study to know whether a plant is surrounded by all the proper safeguards, and to be certain of the results that will be had when the furnaces are put in operation.

There is no standard set of conditions which will meet every case. It is the aim of the Smoke Department to get all the plants to go in under the best engineering conditions possible. A plant in the first place should be correctly designed and built, with due consideration given to all requirements for smokeless combustion, and then it should be properly operated. Any furnace designed for smokeless operation, whether it be mechanically or hand fired, is merely a tool provided for the fireman in order that certain work can be done. Therefore, proper operation is the most important thing of all, and this can only be regularly obtained by a strict enforcement of a smoke ordinance by the city.

If an existing plant cannot run within the ordinance, and the necessary changes to fit it so as to run within the ordinance are practically out of the question, then the Department can and does recommend a coal of less volatile content than the grade ordinarily used, but this is taken more or less as a makeshift, due to the fact that semi-bituminous coal is not always obtainable in the Chicago market on account of weather conditions, obstructed railway traffic or to labor troubles, and this recommendation, therefore, is made only to tide the plant over until such time as it can be rebuilt.

Condition Studied Thoroughly.

A plant that violates the smoke ordinance at frequent intervals is given special attention by the engineers of the Department. These engineers visit the plant, while it is under operation. After a thorough investigation of conditions, such as fluctuation of load and draft facilities, which would include breeching area, size of stack, gas passages through the boilers, etc., together with the character of fuel, construction of furnace and every other item which has any bearing whatever upon the operation of the plant, tending to produce or prevent smoke, has been taken into consideration, recommendations are made as to the best course to pursue in order to eliminate smoke.

In plants where considerable reconstruction is necessary, these visits often cover a period of several weeks, and in some cases even months, before the engineer is thoroughly familiar with all the difficulties to be overcome in the plant, and is in a position to make recommendations which, if followed, may necessitate the expenditure of considerable money. Owners, consulting engineers and chief engineers of plants sometimes think that the Department's recommendations are far more sweeping than are necessary for the results sought, and in cases of this kind it is necessary to work with them and devise a scheme whereby such work as they do will be a benefit and a part of the general plan of improvement to be executed step by step.

Typical Example.

The following is a case in point: The plant has ten 450 h.p. water tube boilers with chain grate stokers. They were vertically baffled and set six feet from the boiler header to the floor line. The grates were entirely under the boilers. The breeching was behind the boilers with uptake connections one-half the width of the boiler setting, and the breeching was of comparatively small area, leading directly to the stack, of ample area, and 275 feet high. The De-

*Smoke Inspector of Chicago, in "Industrial Canada."

partment's recommendations were, to lower the floor three feet, and draw the grates out four feet; lower the combustion chamber floor to the rear of the bridge wall, giving a freer passage for gases from the second to the third pass of the boilers; enlarge the dampers to the full width of the boiler setting; enlarge the opening into the stack and increase the size of the breeching back of the five boilers nearest to the stack.

In this particular case, the company and their consulting engineers did not think that work of as extensive a nature was necessary, therefore, it was decided to lower the floor three feet and draw the grates out four feet. This work was done and there was a noticeable improvement in the amount of smoke made, and a slight increase in the capacity of the plant, with better economy. Later, the company was persuaded to lower the floor to the rear of the bridge wall. A few months later, the opening into the stack was enlarged and the breeching increased to an area that was ample. There remains yet to be done the enlarging of the dampers and some slight modifications in the construction of the ignition arches of the furnaces, but as the plant now is, the capacity has been increased more than 60 per cent., as compared with what it was before alteration work was started three years ago. The efficiency has not been impaired, and the smoke conditions have been improved so that at the present time it is seldom that the plant makes objectionable smoke.

There is another plant which had eight chain grate stokers under water tube boilers vertically baffled. They were burning shavings on most of these grates, and coal on some of them. The plant has been changed. Six of the chain grates have been taken out. Dutch oven furnaces with three span deflection arches were installed in their stead. The entire system of handling shavings has been materially altered. This work took about one and one-half years to do after it was decided definitely what could be done, as it was absolutely necessary for the plant to be kept in operation at all times, and it was not known at first, positively, what was the best design of furnace for that particular plant, as the problems presented were unusual. Now, it is possible that the plant does operate, day after day, without any dense smoke, where previously it made the blackest smoke continuously.

Owners Co-operation.

There are hundreds of instances where the same procedure has been followed in both large and small plants. Two large plants have been chosen as examples to illustrate the Department's methods of meeting the difficulties, and to show that it expects the large plant as well as the small one to comply with the smoke ordinance. As a general rule, the Smoke Department first finds out what is necessary to be done in a plant in order that it may operate without violating the ordinance, and an effort is then made to get the owners to do the work that will give satisfactory results. If it is impossible to get sufficient co-operation from the owners so that they will work out the solution of the smoke problem in their particular instance, resort is made to the court for prosecution on evidence of violations by their chimneys. When, in the judgment of the Department, a consistent effort is made to better conditions, prosecution for violations is not instituted, as the purpose of the Smoke Department is to eliminate smoke and not cause fines. The most difficult part in building or operating a plant or furnace properly is to get the hearty co-operation of all parties having anything to do with the job. After getting this co-operation the rest of the problem is comparatively simple. The results to be had without such co-operation will not be satisfactory.

Smoke Department Criticized.

The Department has been subject to considerable criticism for its activity in undertaking to advise people in trouble with regard to reconstruction work. However, it must be borne in mind that the purpose of the Department is to suppress smoke; that the public is looking to the Department to relieve it of the unnecessary air pollution caused by smoking chimneys, and that the Department must, of necessity, get action. To illustrate this point a recent case may be cited, in which an old type mechanical furnace was giving a great deal of smoke trouble.

A reputable consulting engineer approached the company with a proposition to put the plant on its feet both from efficiency and smoke standpoint. The proposition was rejected, although the company was at the same time professing to the Smoke Department that it was willing to do anything within reason to prevent the plant from violating the ordinance. Finally, after having been in Court a few times, the management instructed the chief engineer to hire a bricklayer who would be willing to work ten hours for $2.00 per day, and a helper at $1.50 per day for twelve hours. With this force, work was started on the reconstruction of the furnaces, after having obtained engineering advice from the Smoke Department. The work was supervised by the Department, and by the stoker manufacturer whose product happened to be used in the plant. The job was finally completed and the stack satisfactorily cleaned up. The case illustrates the half-hearted way in which some owners attack the problem, and the reluctance with which they spend any money in trying to solve their difficulties.

KEEPING THE SHAFTING IN LINE.

By C. R. Trowbridge

WHEN a line shaft is originally erected, it is presumably straight and true, and the hangers and bearings by which it is supported are, or should be accurately aligned and firmly secured. It is unfortunately true, however, that few such installations are permitted to remain in the correct relations in which they have been placed. Variations in loading upon floors, settlement of piers, unequal belt stresses, burden of pulleys and especially frequent disconnections and reconnections, combine to affect the truth of the whole and to prevent it from keeping in line. Under such circumstances, it is essential that the properly designed transmission system should include ample opportunity for self-adjustment and for local correction.

The fundamental requirement of a satisfactory journal bearing is that it shall be truly in line with the shaft itself. This includes some form of freedom of movement, such as is given by a ball-and-socket support, permitting a small amount of oscillation in any direction to conform to the direction of the axis of the shaft. Such an adjustment is recognized as an essential to every well designed hanger; but too often it consists merely of a sort of looseness which permits wobbling in any way, and does not provide really proper support. A true ball-and-socket unites firmness with adaptability and is self-adjusting, so far as variation in direction is concerned.

There is another set of adjustments, however, which demands individual attention, but which should be capable of being effected easily and accurately. These adjustments provide for the bodily movement of the bearing, both vertically and laterally, to conform to any actual shifting in position of either shaft or hanger. With such adjustments, capable of correcting for any change of position and yet free, independent and unintentional shifting, the problem of keeping the shaft in line becomes simplified to an extent which renders excessive friction losses inexcusable.

The question of lubrication has been met in a number of ways, and the so-called self-lubricating bearings require so little attention that this point may be considered as wholly solved.—Iron Age.

A good salesman is like a good cook, he can create an appetite when the buyer isn't hungry.

Practical Data Relative to the Erection of Shafting

By Joseph Horner

Shafting for the transmission of power through belts, ropes, gears, etc., forms a prominent feature of our factories and industrial plants generally. The necessity of giving its installation more than ordinary attention, and the points to be observed when doing so, are fully dealt with by the writer in the accompanying article.

THE friction of shafting is very considerable even under the most favorable conditions, while, under bad conditions, it is excessive. The chief cause of the latter may be summed up in a phrase—lack of alignment. Three things are contributory to this—shafts bent and crooked, bad setting and fixing of bearings, and the effects of settlements and wear and tear. The results of each of these are much worse with rigid and plain bearings than with swivel, ball and roller bearings, but they occur in greater or less degree with all types. Departure from absolute accuracy should be avoided, because the effects are liable to be cumulative. One element of error may act in a fashion which will add to and increase that of another kind instead of neutralizing it. The shaft and bearings may be out of truth in opposite directions, and one bearing may be out in the opposite direction to the adjacent bearings. Accuracy, therefore, in each element is essential, if the truth of the whole system is to be maintained.

Difficulties of Erection.

What renders the alignment of shafting so difficult to secure in the first place is that there is no very tangible datum line from which to operate. There is nothing corresponding, for example, to the surface of a lining off table, or the bed of a machine, or an angle bracket or machine centres. Everything must be primarily referred to the spirit level and plumb line or water trough, and all tests must be made by these alone. The very refined methods of the machinist have no scope here, although the ultimate results should be nearly as

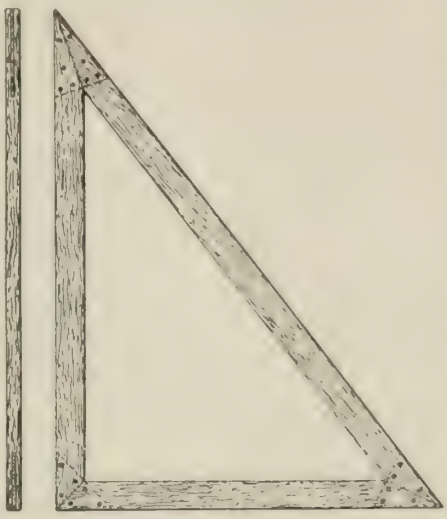


FIG. 2. LARGE WOODEN SQUARE.

exact as those obtained by the machinist. The work is nearly identical with that of the erection of large structures, such as fixed cranes, overhead travelling and gantry cranes, conveying systems—work which is done by men who are fitters or millwrights and specialists in erection where plumb lines, levels, straightedges, parallel strips, straining lines, packings and their adjustments, are the principal aids.

Weak Shafts.

Bent and crooked shafts have also been a fruitful source of friction in shafting, much more so in the old days of wrought iron shafting than at the present time when the employment of steel is universal. The sight of weak, wobbling shafts was a common one some years ago. They were weak in themselves and inadequately supported by their bearings. At that time it was usual to turn only the journal ends of the shafts, together with such short sections as had to receive pulleys or gears. The principal portion of the length being rough, as rolled, tended to develop wobble and eccentricity, especially as the shafts were nearly always too weak for their work. Moreover, they became in time overloaded by further additions of pulleys and gears, which they were never originally intended to carry, with the inevitable results of sag and wobble. From such bad practice, steel shafting and more enlightened methods have come to the aid of millwright. Stiffer and stronger, although lighter, steel shafts do the work of the heavier wrought iron ones, with reduction of friction. They are supplied either turned or rolled.

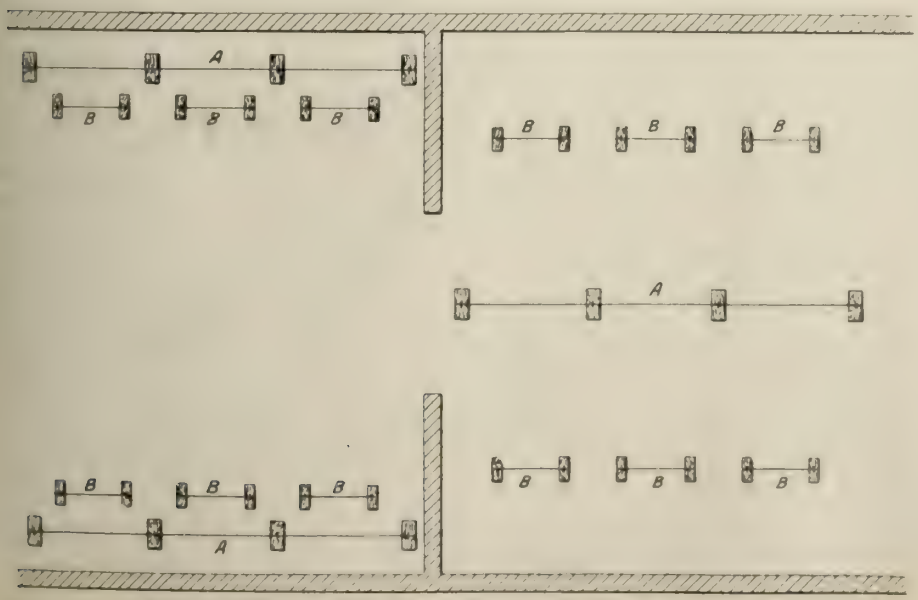


FIG. 1. ALTERNATIVE ARRANGEMENTS OF SHAFTING.

FIG. 3. ERECTING A RIGHT ANGLE.

Inaccurate Fixing of Bearings.

Bad setting and fixing of bearings may double the friction, and so produce injurious heating and cutting of journals, thereby necessitating more frequent and copious lubrication than if bearings were properly aligned. Excellent results may be obtained with the old style of rigid bearings, if they are aligned correctly, and bad results follow, on the other hand, with adjustable bearings poorly set. The latter, however, are preferable, because they accommodate themselves to slight inaccuracies, and mask and neutralize the effects of indifferent workmanship.

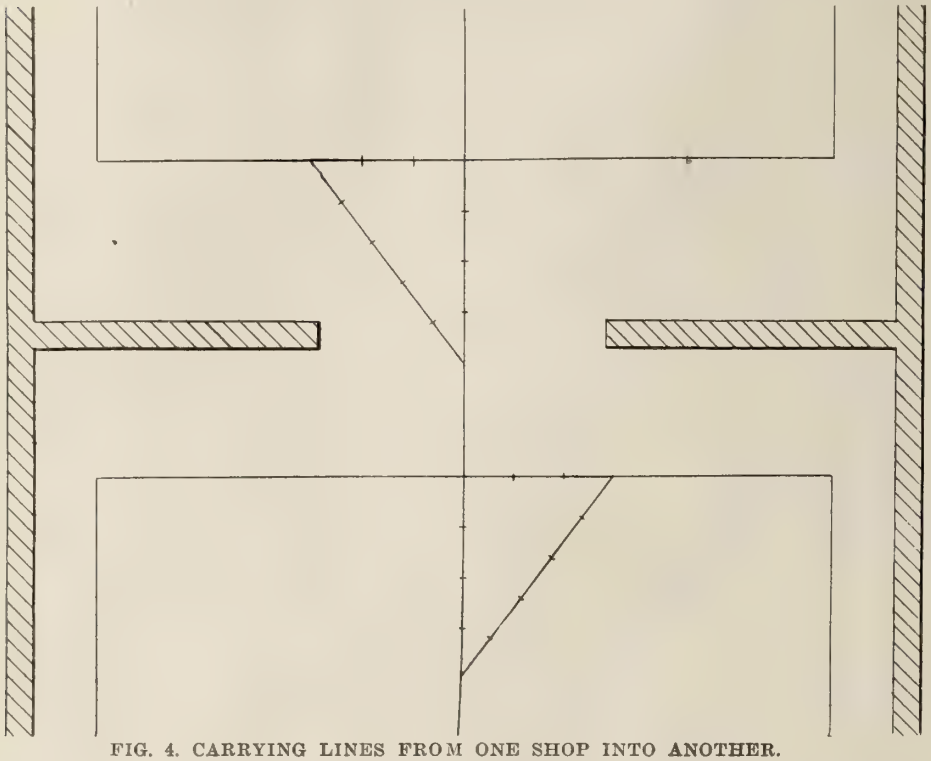


FIG. 4. CARRYING LINES FROM ONE SHOP INTO ANOTHER.

The Influence of Wear.

The effects of wear and tear are more serious with rigid bearings than with adjustable ones, for, although bearings are set in absolute alignment, they may get out of truth in a year or two, in consequence of slight movements in beams, walls, foundations, which movements may increase with more or less irregularity. Corrections and readjustments will, therefore, be more imperative if the bearings are of rigid type than if they are self-adjusting. The risks of settlement are not very serious in the basement of a well-constructed building, or in the beams of a substantially built one-storey shop, but they are always present in the storeyed shops, where the beams which carry the floors have also to carry the shaft bearings. The floors sink and the beams become distorted. This is especially noticeable in new shops, if the shafting is erected before the machines are laid down. Then subsequent corrections are inevitable.

The Lay-out of Shafting.

With regard to the disposition of line shafting, this must be governed by the features embodied in the design of the building. In a narrow shop it is usual to fix the line shaft bearings to one wall. In large modern shops, having bays separated only by columns, the bearings are attached to these columns, and the belting drives from each side, or the hanger form of bearing may be used and bolted to the under sides of the joists above, which are part of the roof principals, or which sometimes support an upper floor. The methods by which the bearings are attached to walls, columns or joists vary greatly, and the fact that they are designed to suit all conceivable conditions, explains the differences in the shapes and means employed.

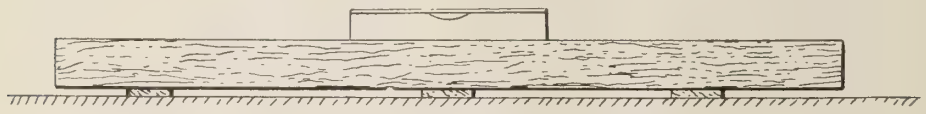


FIG. 5. LEVELLING DATUM BLOCKS.

Methods of Erection.

There are two ways of erecting shafting; one, which is by far the better, consists in working from the floor, while the other involves working from the beams above. Such beams, however, are often absent. The first can always be adopted in a new shop, but if the floor is already occupied with machines, the second plan may be accepted, although it is preferable, with the modern style of roof, to attach the bearings to columns. Frequently, in smaller shops, timber beams are bolted along the roof principals solely to receive the counter-shaft bearings.

Erecting From the Floor.

In working from the floor, the positions of the shafts to be erected are laid down upon it, beginning with the main line shaft or shafts. From these are marked the secondary lines and the countershafts. In Fig. 1 two common alternative dispositions of shafts are outlined in diagram in plan. In that to the left, the line shafts (A) (A) occupy the sides of the shop, driving to the countershafts (B) (B), farther away from the walls. In the other to the right, one line shaft (A) runs down the centre, and drives to the counters (B) (B), right and left. The latter is not always practicable in wide shops, but is more economical in those of moderate width.

Laying Down Centre Lines.

When lines of shafting occur at right angles, a square is hardly correct enough to use, unless a very large wooden one, measuring several feet along the sides, is made and kept for the purpose, like that shown in Fig. 2. It is made of narrow strips of wood abutted at the corners and tongued, with the pieces fitted

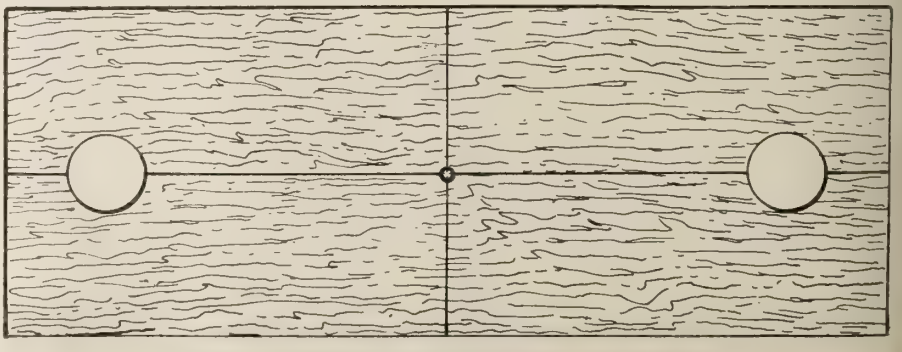


FIG. 6. TEMPLET FOR MARKING BOLT HOLES.

FIG. 7. ADJUSTING BEARINGS BY SPIRIT LEVEL AND PARALLEL STRAIGHT EDGE.

and glued into a saw kerf, and all secured with glue and screws. Such a square, apart from rough usage, maintains its accuracy permanently, yet the geometrical relation, of (3), (4), (5) Fig. 3, is better. Feet or yards can be used according to the lengths of the shafting, and a trammel employed to lay down the dimensions, or a light rod marked off in the lengths required. The lengths (3) and (4) will be at right angles with each other.

This is plain sailing, when the work lies on the floor of one shop, but when shafting has to pass through walls into adjacent shops, one has to be careful, since measurement from walls is not considered permissible. A correct method, then, is to use the doorway to carry a datum or centre line through from one shop into the next, Fig. 4, extending either along the whole length of each, or for as much of the length as may happen to be required. From it the centre line or lines of shafting can be set off parallel on the floor. When parallel lines of shafting are required on opposite sides of a wall, as in Fig. 4, additional care must be exercised. If the length of one shop is enough to be a guide, a long fine line can be safely stretched to coincide with that line laid down, and extended into the one adjacent. If not, the most suitable method to adopt is to raise a vertical (B) from the centre line (A), Fig. 4, already existing, and from that to raise another vertical (C), which will then be in line with the first. The relation (3), (4), (5) will be used.

Centre lines are snapped with a fine chalked cord used in the same way that wood workers do. It is held taut by a man at each end, while another at the centre lifts it a few inches perfectly plumb, and lets go sharply. A fine chalked line will thus be transferred to the floor. As many lines are snapped as there are lines of shafting, all being set down by careful measurement parallel with or at right angles with each other. At the end of each line a small nail is driven in to be a permanent record in case the lines should become obliterated.

Levelling the Basis Line.

These datum lines correspond with the intended positions of the various shafts in plan, which shafts, eight or ten feet above, will now have to be plumbed over them. The horizontal truth of the shafts has to be set in the first place by measurement and then checked by a spirit level. To accomplish this a level base is required on the floor. A convenient method is to nail strips across on the centre lines, Fig. 1, corresponding with the positions over which the bearings will be plumbed, and reduce the surfaces of some or of all with a plane until a parallel straight edge carrying a spirit level, and moved across from one to the other, Fig. 5, shows that they are level throughout. At the intersection of the centre line of the shaft with the centre of each bearing, a small nail is driven in as a permanent witness. From these nails as centres the bearings are fixed, the methods of doing which vary with the designs and methods of attachment.

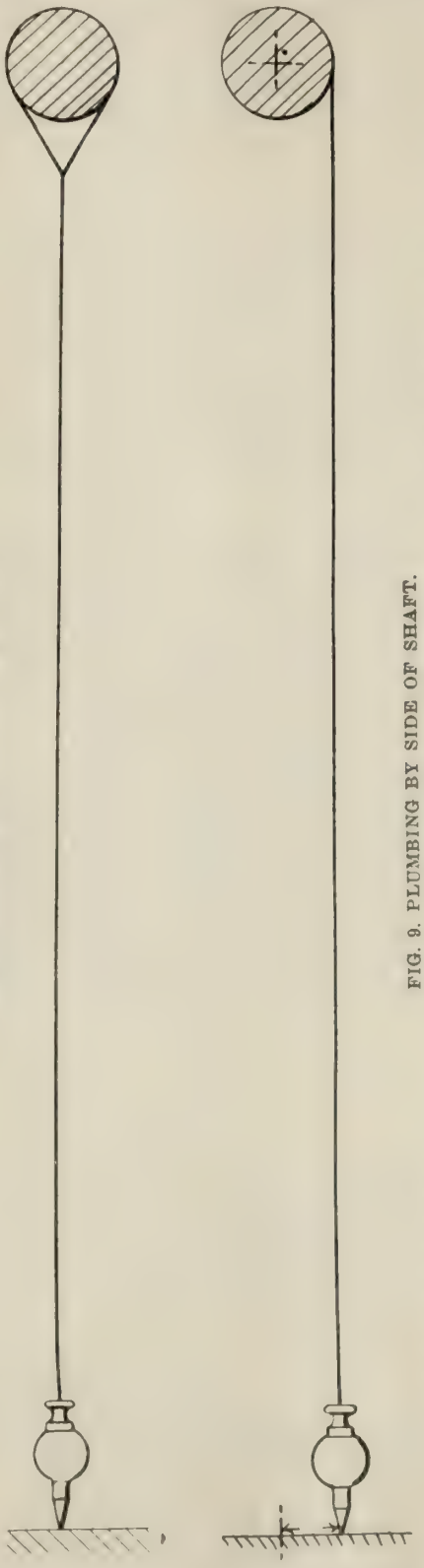


FIG. 8. PLUMBING BY CENTRE OF SHAFT.

FIG. 9. PLUMBING BY SIDE OF SHAFT.

Instead of fastening datum pieces on the floor to obtain a truly horizontal base, a long narrow water trough has been used, although a more compact method still is the hydrostatic level of the Webster Manufacturing Co. In this, two vertical tubes are connected with a length of hose fitted with stop cocks. The height of the water in the tubes, set any distance apart, gives a true level. The level can be graduated in inches and parts of an inch within a range of 3½ inches.

Approximate Settings.

From this point of departure, bearings may be fixed as plummer blocks to beams overhead, or as hangdown bearings from beams, or as wall brackets of various shapes. Different means are necessary in each, and these will be considered in turn. Also, the work is naturally divided between two stages, the first being more or less approximate, the second corrective and exact.

Fixing Plummer Blocks on Beams.

The first thing to do is to get a centre on the underside of the beam plumb over the corresponding centre on the floor. This is easier said than done, with a bob swaying very slowly to rest. A boy below must steady the bob while the man makes adjustments on the ladder. The cord may be held in the fin-

gers, and from it a centre be marked on the underside of the beam to correspond with that below. A templet has to be prepared corresponding with the foot of the bearing, or of its separate sole plate if such is used, the bearing or sole plate, as the case may be, having to be bolted on top of the beam. The templet, Fig. 6, has a centre bored in it

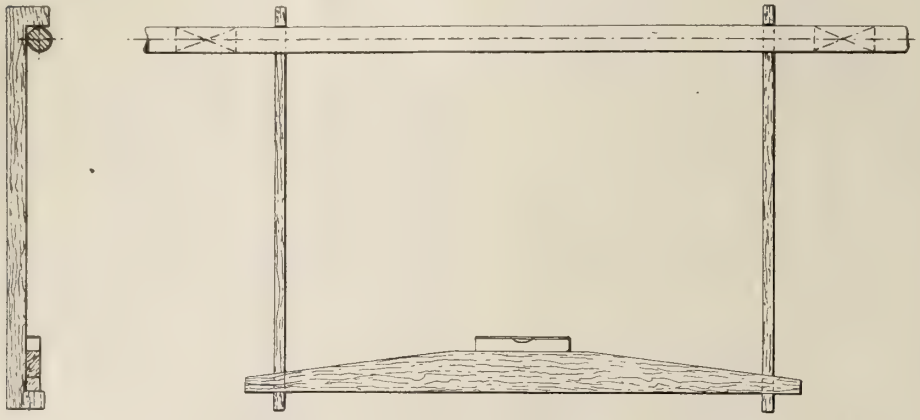


FIG. 10. ALIGNING SHAFTING WITH STRAIGHT EDGE, SPIRIT LEVEL AND SUSPENDED RODS.

and two bolt holes, or four, to correspond with the bolt holes in the foot or in the sole plate. The templet is laid against the lower face of the beam, and centred through its centre hole to the hole already plumbed up from below. The bolt holes are then marked through it, and bored with an auger as perpendicularly as possible. Instead, however, of proceeding in this way, it will be rather easier to pass the plumb line through the centre hole in the templet, lay the latter on the lower face of the beam, clamp it tightly, and adjust it by tapping the edges until its centre is right. The bolt holes can then be marked through, the centre marked by the intersection of the two centre lines on the templet, transferred to the beam and scribed.

By means of the bolt holes, the bearings will be loosely set and attached in place on the top of the beam, but not finally tightened up until they are tested carefully for plumb. Usually, ⅜-in. of play across the line of the shafting is allowed in the slot holes of plummer block feet or sole plates to permit of adjustment, and to compensate for the rough character of the holes bored. If the bearing fits on a sole plate, the former usually alone has adjustments on the plate, and if bolted directly to the beam, its foot has slot holes.

Packing Up.

Bearings of ordinary form have no provision for vertical adjustment. These, therefore, or their sole plates, usually require packing pieces to level them up to compensate for inequalities in the beams. They, also, are fitted before the bolts are finally tightened. The approximate thickness of packings required can be obtained by sighting along the series of beams with a surveyor's level, and getting an assistant to mark the height or thickness of each packing on a strip of wood laid on the beam. Pieces will then be planed to those thicknesses, and laid under the sole plates or the plummer blocks, after which the exact levelling will be done directly from the shafting, which is now inserted. This may be done before the final lateral adjustments, or subsequently, preferably, the latter.

Checking for Level.

Before laying the shafting in its bearings, much subsequent adjustment may be avoided by laying a parallel straightedge in the bottom of the open bearings and trying a spirit level on the straightedge, Fig. 7. The straightedge can be shifted from bearing to bearing along the whole line, and the thicknesses of the packings corrected. When each contiguous pair of bearings is levelled thus, one from the other through the series, the whole must be in alignment. The shafting can then be laid in.

Use of the Straining Line.

The straining line is of fine hard brass or copper wire. Owing to its deflection, it cannot be used with accuracy for horizontal adjustments, the straightedge and spirit level being much more reliable, preceded, if desirable, by measurement up from the datum blocks on the floor by means of a rod. If, however, it is strained by a weight at one or at both ends, the wire passing over pulleys, most of the sag can be pulled out of it and allowance made for the slight residium by sighting along. It may also be supported in each bearing, on a strip of wood bridging the bearing, flush with the joint, and then sighted along. When adjustable bearings are used, this is accurate enough for the preliminary adjustments, leaving the final ones to be made with the spirit level, after the insertion of the shafting.

The straining line of wire is, however, more properly employed for making lateral alignments, being usually strained along the edges of the open bearings before the shafts are inserted. It may, however, be strained along the centres, but in that case the bearings must be bridged with strips of wood on which the centre lines will be scribed.

Making Lateral Adjustments.

Lateral adjustments are made or checked also, by the centre lines on the floor by plumbing down from the shaft itself. This may be done by looping a cord round the shaft so that the cord hangs from the centre with the plumb bob on the end, Fig. 8, or the line may be hung over the shaft at one side, in which case measurement must be taken from the bob to the centre line, Fig. 9, the distance being, of course, one-half of the shaft diameter. The bearings are tapped laterally in one direction or the other until these adjustments are made correctly, after which the bolts may be tightened up provisionally.

There are short cuts available in cases where a large number of bearings are in question, as occurs in long lines of shafting. In such circumstances the intermediate bearings can be adjusted laterally by means of a cord strained along the whole length to form a datum for the lateral alignment. A cord is dropped from each end of the shaft and the datum line strained along just in contact with these. From each bear-

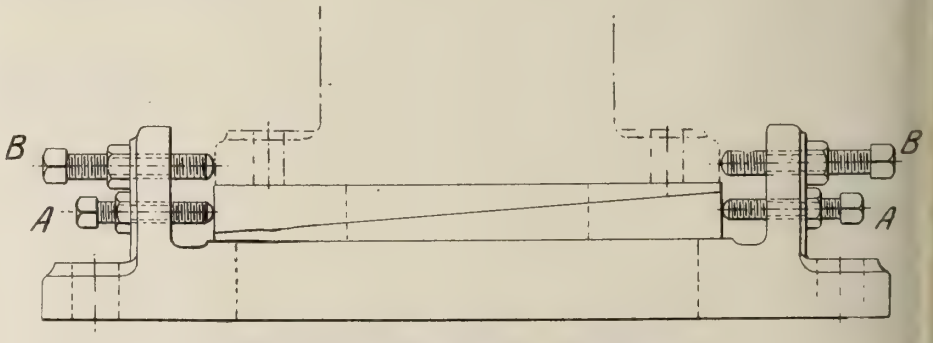


FIG. 11. WEDGE-ADJUSTING SOLE PLATES.

ing, a line is dropped and adjustments are made until each line makes contact with the horizontal cord.

Horizontal Adjustments.

To effect the final adjustments of shafting horizontally, a spirit level placed directly on it would not give accurate results. A better method is to lay a long parallel straightedge and place the spirit level on that so as to check its departure from truth and make adjustments by the thickness of the packings, taking a few shavings off those where the bearings stand highest. This involves getting up and down ladders; a neater way, therefore is to hang hooked rods contiguous to adjacent bearings, Fig. 10, lay a parallel straightedge on the lower hooks, and test with a level laid on the straightedge, and so on through the series.

Alternative to the wood packings previously mentioned, the use of folding edges, Fig. 11, affords a more convenient mode of adjustment. The wedge pieces are sufficiently wide to reach across the width of the plummer block base, and are slotted through from each end for the bolts. The lower screws, (A) four in number, effect the adjustments of the two strips, and the upper ones (B), of which there are two, adjust the lateral position of the plummer block.

PROTECTION OF BOILERS.

THE Cumberland Electrical Process for the Protection of Boilers has been introduced into the United States with a view to preventing the corrosion of boilers. It consists of the use of one or more electrodes installed in the boiler, and connected to the positive terminal of a direct-current supply, the boiler being connected to the negative terminal, and the water forming the electrolyte. It is stated that only enough voltage is required to overcome the resistance through the water, and any counter electromotive force due to the difference of potential of the metals of the boiler.

A report issued by the United States Navy Department states that some experiments were carried out on a small fire-tube boiler having brass tubes, with a steel shell, in which five polished steel plates were placed—one on the crown sheet, one across the top row of brass tubes, one across the tubes about the middle of the nest of tubes, one on the bottom of the shell-plate under the furnace, and one at the smoke-pipe end. The boiler being filled with water, steam was raised to 190 lbs. per sq. in. pressure, and kept up for five days, after which the boiler was examined.

There were no signs of hydrogen gas, and the electrode placed in the boiler was found to be considerably corroded. The brass tubes showed no corrosion, nor was there corrosion on the test pieces. Underneath the cathode, and on the tubes and shell, a deposit of black iron dust was found, which could easily be washed off. Old scale had also been cracked off the crown sheet and shell in places. The scale on the brass tubes was also cracked off in places, and could be easily washed away. The iron electrode in the water was, it is stated, very badly corroded.

CAPACITY OF ROUND TANKS.

THE accompanying table, taken from the "Motor Boat," giving the capacity of round tanks, will possibly be found useful in many departments of manufacturing and industrial plants:

Diameter in inches.	Gallons per inch.	Weight in lbs. per inch. Sp. G. .73 Petrol.	.796 Refined Paraffin.	.81 Scotch Paraffin.	.85 Crude Oil.	.895 Lubricating oil	.93 Fuel oil.	1.0 Water.
6	.0969	.7074	.7713	.7849	.8236	.8672	.9011	.969
6½	.1134	.8278	.9028	.9186	.964	1.015	1.055	1.134
7	.1304	.9520	1.038	1.056	1.108	1.167	1.213	1.304
7½	.1514	1.105	1.205	1.226	1.288	1.355	1.408	1.514
8	.1719	1.255	1.368	1.393	1.461	1.539	1.599	1.719
8½	.1943	1.418	1.547	1.574	1.651	1.739	1.807	1.943
9	.2180	1.591	1.735	1.766	1.853	1.951	2.027	2.18
9½	.2425	1.77	1.930	1.964	2.061	2.170	2.255	2.425
10	.2690	1.964	2.149	2.186	2.294	2.416	2.510	2.69
10½	.2968	2.166	2.363	2.404	2.523	2.656	2.76	2.968
11	.3253	2.375	2.589	2.635	2.765	2.912	3.026	3.253
11½	.3557	2.597	2.831	2.881	3.023	3.183	3.307	3.557
12	.3876	2.829	3.085	3.14	3.294	3.469	3.605	3.876
13	.4546	3.319	3.619	3.683	3.864	4.069	4.228	4.546
14	.5270	3.847	4.195	4.269	4.48	4.717	4.901	5.270
15	.6057	4.422	4.821	4.906	5.148	5.421	5.633	6.057
16	.6887	5.027	5.482	5.579	5.854	6.164	6.405	6.887
17	.7772	5.673	6.187	6.296	6.606	6.956	7.228	7.772
18	.8722	6.367	6.942	7.064	7.414	7.806	8.112	8.722
19	.9712	7.09	7.73	7.866	8.256	8.692	9.032	9.712
20	1.076	7.855	8.566	8.716	9.146	9.632	10.07	10.76
21	1.187	8.665	9.45	9.616	10.09	10.62	11.04	11.87
22	1.302	9.504	10.36	10.55	11.07	11.65	12.11	13.02
23	1.423	10.39	11.33	11.53	12.10	12.74	13.23	14.23
24	1.550	11.32	12.34	12.56	13.18	13.87	14.42	15.50

LOCOMOTIVE SUPERHEATER DESIGN.

HITHERTO, it has been the almost invariable practice to design a locomotive superheater entirely without reference to the construction of the smoke-box, except, perhaps, as regards capacity. According to the Railway Times, however, Mr. S. M. Vauclain, of the Baldwin Locomotive Works, Philadelphia, proposes to construct the smoke-box in a special manner to adapt it for receiving and carrying the header of the superheater. The circular smoke-box is cut away at the top, so that its walls enclose only about 250 degrees. The uncompleted portion provides an opening sufficiently large to permit of the superheater header being passed through it from above, and this header is so constructed that it combines, with itself, a casting shell, which, when riveted to the smoke-box shell, complete the circular form thereof. The header casting also receives the joints of outside steam pipes—presumably for use with large Mallet articulated engines—so that all the connections and steam passages are combined therewith, the steam inlet pipe at the top, and the two delivery pipes from the superheated steam compartments of the header towards either side.

NEW TUNNEL UNDER NIAGARA.

THE engineers of the Ontario Power Company are considering the construction of a tunnel under the bed of the Niagara River, just above the Horseshoe Falls, the object being to provide a new water course for their powerful turbines. At present the turbines are in diameter, but the ever-increasing demand for power has overtaxed these channels. They are located just under the ground surface, alongside of the street car tracks that go up to Chippewa, and experience has shown that it is not wise to duplicate this construction for future use. One is made of steel, overlaid with concrete, and the other is of reinforced concrete. These are subject to atmospheric changes, and it is on this account that the new location of the other tunnel has been chosen.

The beginning of the new pipe will be at the dam just out from the Dufferin Islands, and it will be carried almost to the brink of the Falls; then it will swing over to the Canadian side, and from here the water will reach the turbine house at the foot of the Falls.

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THE POWER PLANT SITUATION.

THE more or less frequent interruptions, which Ontario manufacturers have recently experienced through the failure of their electric power supply, have not been such as to inspire confidence in the all-sufficiency and dependability of a motive power whose transmission from the source of generation to its place of application, involves long, exposed and apparently easily vulnerable lines.

The vision of harnessing Niagara until not a drop comes over the Falls, leaving a bare, steep cliff, is dangled in front of our imagination to help sound the death knell of power generation by fuel combustion, and all too much attention is being directed to coal and oil supply exhaustion, and under cover of it, opportunity taken to knock steam and internal combustion engines. It is altogether too obvious, this "drumming out" and "buying out" business. Power generation by fuel combustion is a serious competitor of both Hydro and Toronto Electric, etc., and each has to come some to meet this competition. We are not seriously worrying as to when the supply of combustible peters out, but we do want now the cheapest and most dependable power with which to carry on our business. Glorifying this or that promoter, and knocking this or that opposition, are each uncalled for, and show weakness and bad taste; besides being unbeneficial generally.

It seems to be forgotten that power users are out for the power supply that will pay them best now, and on this ground only must any public utility corporation who cater to them be judged. Too much dependence and blind trust has been placed in the almightiness of one or two individuals connected with Hydro-Electric, with the result that industrial Ontario has been brought practically under obligation to it. Shut-downs in our factories are becoming of a more frequent and prolonged nature, and no self respecting management can afford to allow its business to be demoralized with impunity by any power corporation. There is broadcast ignorance concerning cheap power, thanks to the importunate and persistent campaign propaganda in operation by those opposed to steam power and fuel combustion generation systems.

Much loose talk is being indulged in regarding the establishment of steam auxiliary plants by our supply corporations, and if one thing serves more than another to show how much our industries are at the mercy of incompetent power management, it is the connoisseur air adopted by men who could not distinguish between a motor and a roll of toilet paper. The auxiliary steam plant proposition, let us add, will be in no sense a cure-all, and is nothing more or less, than bare-faced bluff. A year ago, Toronto Electric, when its troubles had reached "peak load," set about the auxiliary proposition, so as to protect their customers. How well they have succeeded, everybody knows. Hydro-Electric a year ago, was "cock of the walk" and infallible; to-day it is panicky and its administration at sixes and sevens.

The works or factory steam power plant is more dependable than any source of power, where long transmission lines intervene, and we are rather of opinion that the overdue return to its own of the individual steam power plant is within measurable distance.

Our operative engineers, at least, those of them belonging to the Canadian Association of Stationary Engineers will be in convention at Owen Sound, Ont., within the next few weeks, and opportunity should be taken of the occasion by the Executive Body to impress on each individual member of the fraternity, that while hydro-electric power does and will continue to fill a large place in the industrial life of this Dominion, there is not only room, but necessity for the existence of steam power plants, and that an increasingly high degree is called for in the management and operation of the latter. If operators had been sufficiently alive to the situation, less heed would have been given the tales so assiduously peddled around relative to the passing of power generation by steam.

ELECTRICITY AND HYDRAULICS

This department is intended, in addition to individual treatment, to feature the close relationship existing between electricity and hydraulics in the power and light field.

HYDRO-ELECTRIC DEVELOPMENT, DRYDEN, ONT.

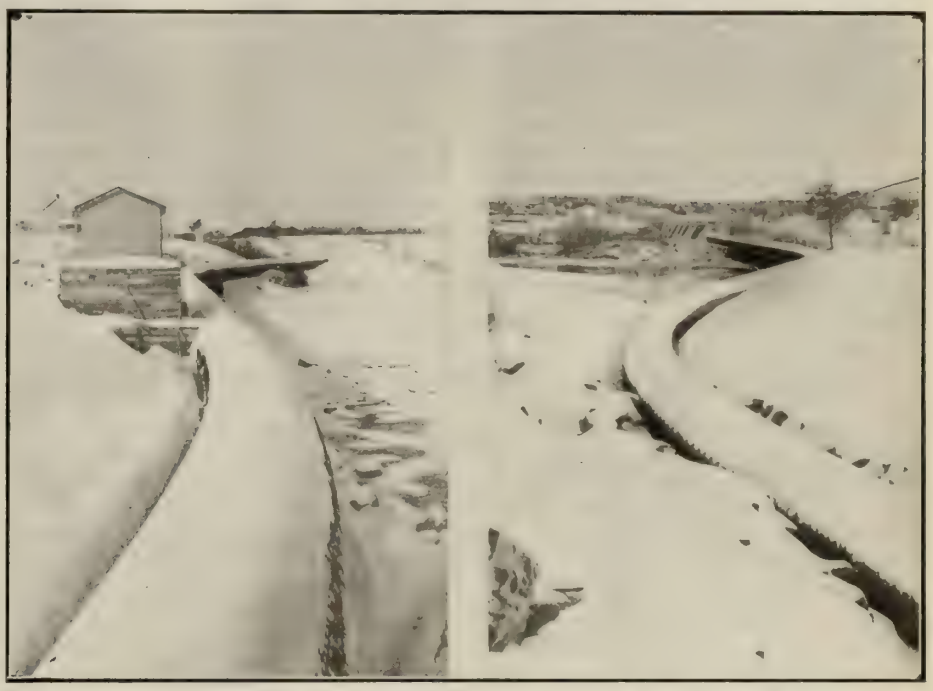
DRYDEN, Ont., supports a population of nearly a thousand, and is the home of quite a large industry, known as the Dryden Timber and Power Co. It stands on the Wabigoon River down which flow the logs which feed the mills; its falls supplying the power. Incidentally, the Dryden Timber and Power Co. have been negotiating to supply the town with power and light, which it is well fitted to do. Less than a mile from the mills up the river, are the falls which operate the wheels.

The 2,000 h.p. hydro-electric development has just been completed there by Harris & Harris, civil engineers and contractors, and Chapman and Walker, electrical engineers and contractors. The plant is situated on the Wabigoon River, about one mile from Lake Wabigoon and supplies power to a 50-ton per day sulphite pulp and paper mill. Lake Wabigoon has an area of about 60 square miles of still water, and thus presents a very favorable reservoir for a power development. The area of the water shed is about 800 square miles, and the available flow in the river about 400 cubic feet per second. On the site of the development there are three falls in a distance of about 1,600 feet, the total fall being about 50 feet, and the net head on the turbines, 45 feet.

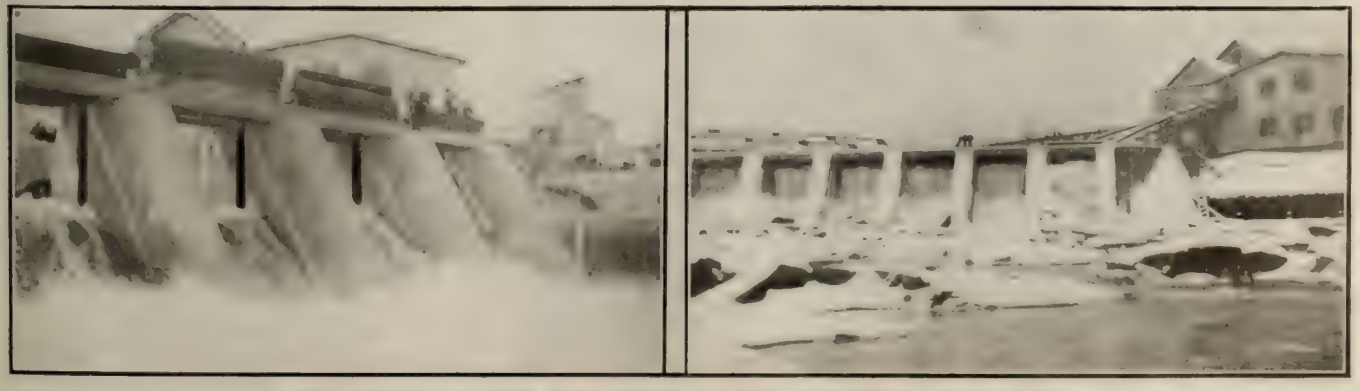
Concrete Dam.

The hydro-electric development consists of a concrete dam about 25 feet high, a wood stave pipe line 1,500 feet in length, and a reinforced concrete power house with open wheel pits and surge tank. The dam is about 120 feet in length, and is built on rock foundation. It consists of a series of piers 16 feet centre to centre, with stop logs between, and a reinforced concrete slab on the top connecting the piers, upon which is a track for the winches operating the stop log. The stop log winches were supplied by the William Hamilton Co., of Peterboro', who also supplied the gate operating winches in the power house.

The dam is built on an angle across the river, resulting in a fore-bay, which gradually diminishes in width to the mouth of the pipe. The pipe is connected to the dam by means of a steel thimble set in the concrete, and racks and stop-logs are placed in front of the pipe



THE FLUME, LOOKED AT FROM THE DIRECTION OF THE POWER HOUSE AND DAM.

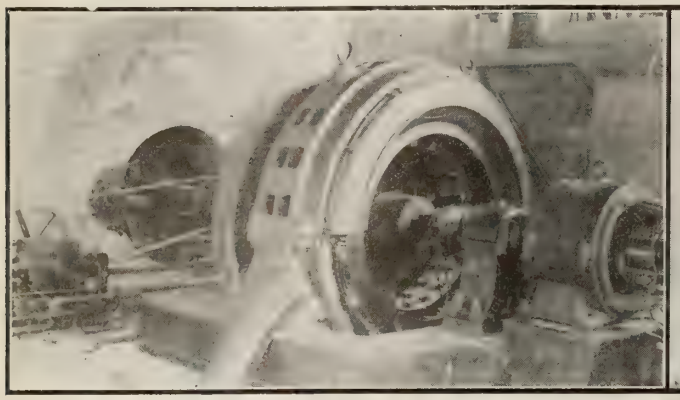


TWO VIEWS OF THE DAM UNDER VARYING WEATHER CONDITIONS.

mouth. The pipe line is nine feet inside diameter, and is constructed of 4 x 8 inch B.C. fir staves, bevelled to shape. The bands are of ¾-inch round steel spaced 9 inches apart. The maximum head on the pipe is 20 feet. The pipe is supported on wooden blocks.

clover leaf, and built of reinforced concrete. The walls of these tanks are two feet thick at the bottom, tapering to 12 inches at the top, and are about 40 feet in height. The circular form of construction, after the method used in grain elevators, materially lessens the

gallery at one end of the generator room. The structural steel used throughout this building, and the racks, were supplied by the Jenckes Machine Co., Sherbrooke, Que., and the inside of the wheel pits were water-proofed with I.D.P. hydro-liquid.



NO. 1 GENERATOR, SHOWING ADJUSTABLE BEARING.

FIVE BARKERS IN THE PAPER MILL.

spaced 10 feet apart, and for a distance of 200 or 300 feet on a trestle from 12 to 15 feet high. In passing under the C.P.R. embankment, a reinforced concrete pipe is substituted for the wood stave pipe. The shell of this concrete pipe is 12 inches thick, and is water-proofed on both inside and outside with water-proofing compound, and a coating of asphalt.

The Power House.

The power house presents some novel features in power house construction. In order to secure good regulation and obviate trouble due to surges in the pipe line under change of load, open wheel pits are used in place of enclosed turbines. The wheel pits are two in number, circular in shape, each sixteen feet in diameter. The surge tank is 22 feet in diameter, and all three are grouped together, in the form of a

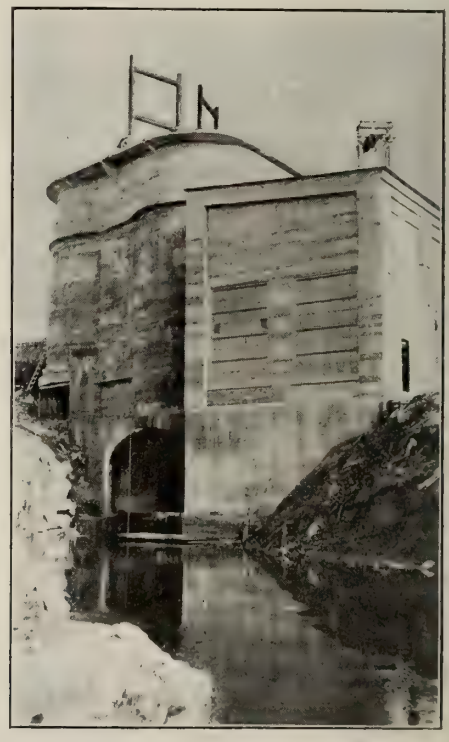
amount of the reinforcing steel required.

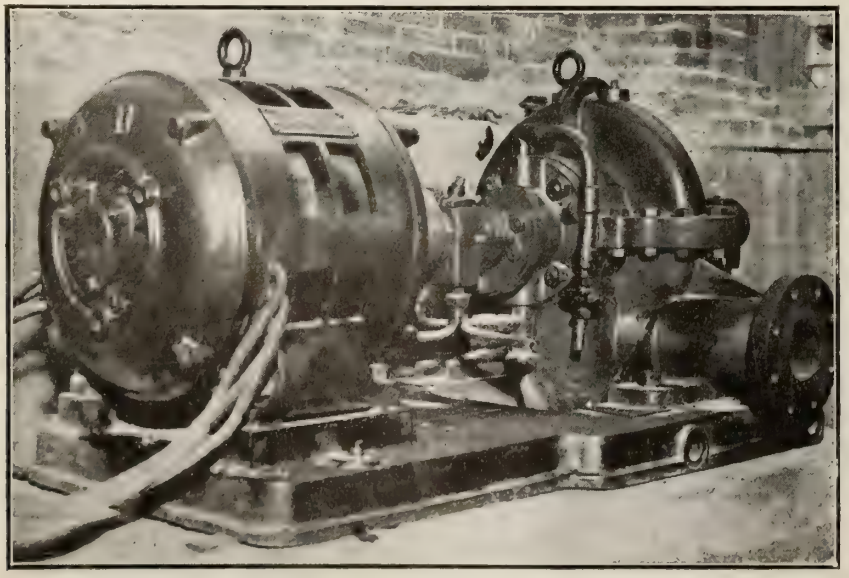
The velocity of the water on entering the wheel pits was kept low—about two feet per second—in order to avoid the danger of an eddy forming there. Wooden gates composed of vertical timbers close the openings, and are operated from above by hand winches. The two turbines of 800 h.p. each, are placed on the floor over the wheel pits about 18 feet above extreme low water. The water is carried off by steel draft tubes emptying into the same tail-race, above which the wheel pits are supported on a concrete arch. The generator room is a reinforced concrete structure, the window area being large and the room well lighted. A 10-ton crane is provided, and the crane rails are placed on reinforced concrete beams. The walls of the power house are 8 inches thick, with pilasters supporting the crane and roof.

The switch board is on an elevated

The Turbines.

The turbines were made by James Gordon, of London, England, and designed from the following data:—Nett head, 45 feet; normal output, 800 b.h.p.; maximum output, 1,000 b.h.p.; normal speed, 360 r.p.m.; guaranteed efficiency at full gate, 81 per cent., ⅞ gate 85 per





CAUSTIC LIQUOR PUMPS IN THE DIGESTER ROOM.

cent., ¾ gate 83 per cent., ½ gate 75 per cent. They are both type 29 Francis twin centre discharge, horizontal shaft turbines. Each is provided with two runners constructed of special cast iron and keyed to a steel shaft. These runners are mounted inside cast iron casings fitted with steel adjustable guide blades with steel connecting links

to an operating ring. Each turbine shaft is provided with one bearing inside the turbine casing, which is lubricated by means of grease cups

The Governors.

The two governors are of the latest design of oil pressure; quick-acting, double-relay type, and are complete with the necessary oil pressure and vacuum pumps, pressure and exhaust pumps and tanks, relay valves, main control cylinders, and connections to gate, control shaft and levers on turbines. The governor heads are of the horizontal pattern, arranged for direct drive from the turbine shafts, obviating the necessity for bevel gears between the governor pulley and the head.

The Generators.

There are two generators, each 750 k.v.a., 600 volts, 60 cycle, 3 phase, directly connected to exciters, on an extension bed-plate. The alternators and exciters were made by the Lancashire Dynamo and Motor Co., Manchester, England. Each exciter is capable of exciting both generators at full load.

The switchboard includes two feeder panels, two exciter panels and station lighting panel. The synchronising gear, busbar, voltmeters, and frequency meters are fitted on an adjustable end bracket. The switchboard is elevated and situated in one corner of the generator room, so that the operator has a clear view across the room to all his machines. The switchboard was made by Ferranti, Ltd., Hollingwood, Lancashire, England.

Overhead Lines.

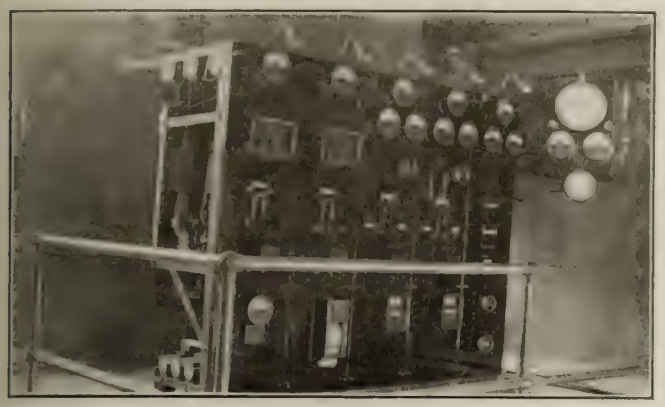
The overhead lines are of pole construction from the power house to the sub-station, being of two-pole structure throughout, with the exception of where it crosses the C. P. R. tracks. Here it is of four-pole construction. The transmission lines are aluminum. The current leaves the power house at 600 volts. At the sub-station there are three 20 k.v.a. transformers for lighting purposes. From the sub-station it is transmitted to the various parts of the works by both overhead system and by cables on racks. The wiring inside the buildings is practically all done on racks.

The sub-station is provided with a panel containing the main feeder switches, and also disconnecting links for these special circuits, into which are divided the motors. Each of these circuits is provided with an ammeter, it being advisable to put them there instead of at the motor.

The motor equipment provided for the various industrial operations consists of 30 a.c. machines, ranging from 7 to 250 h.p., and were supplied by Chapman & Walker, Toronto.

With each motor is included the necessary starting and controlling gear. The motors and switch gear are of the standard mining type, and are made to stand rough usage.

All the pumps used on this plant were supplied by W. H. Allen, Son & Co., Ltd., Bedford, England, for whom Chapman & Walker, Ltd., are Canadian representatives.



The Fire Hazard Feature in Turbo-Generators *

By G. S. Lawlor **

On account of their value and the serious results sometimes occurring when their service is interrupted, it is important that turbo-generators be protected from fire. To reduce the chance of fire damage, it is suggested that exposed coils have non-combustible outer covering, the cooling air be filtered and automatically cut off at time of fire, and that, at the same time, carbon dioxide gas be introduced.

THE chances of electric generators of the older types being seriously injured by fire in the event of some part of the insulattion failing is slight. Occasionally, arcing will ignite the insulation at some point, but it is seldom that the fire will spread much before it is extinguished. This freedom from fire damage is due principally to the comparatively low speeds, the accessibility of the combustible insulation, and the fact that the machines being of large mass per unit capacity, the insulation is considerably distributed.

This condition of practical freedom from fire is reversed in the case of generators of the turbo type, for, when a short circuit occurs in one of them, there is a great chance that the insulation will be ignited, and the machine be badly damaged; in fact such damage has occurred in a number of instances. The chief causes of the increased hazard in the more modern type generators are as follows:

Arcing.

The volume occupied by this type of machine is very much less for the same capacity than that of the older types of generators, so that the combustible insulation is more concentrated and, therefore, much of it is exposed, even to a slight arc or fire. The covering on the conductors depends greatly for its insulating qualities on the presence of oils or gums of a highly combustible nature. The amount of this combustible insulation on the higher voltage generators is naturally greater than in the low voltage machines.

Owing to turbo-generators having only a few poles, the end connections between slots form a large portion of the total length of conductors, in fact, in some designs, approximately one-half

* From a paper read recently before the American Society of Mechanical Engineers.
** Electrical Engineer, Inspection Dept. Assoc. Mut. Fire Ins. Cos., Boston, Mass.

of the coils are outside of the slots. These end connections, one-half being on one side of the machine, and one-half on the other, are exposed to fire, and, as with a pile of loosely laid sticks, fire will rapidly extend from the insulation on one coil to that on the others.

Owing to these generators being of exceedingly large capacity in many instances, one of 30,000 k.v.a. capacity now being constructed, an enormous amount of energy is involved in a short circuit, especially at the instant the short occurs, and, as the arc is confined in the limited space with the combustible insulation, it would seem impossible for the insulation to escape being set on fire at many points simultaneously.

The machines are cooled by forcing large quantities of air through the spaces between the conductors. The large and constantly renewed supply of oxygen will hasten combustion when it is once started. The air is given somewhat of a rotary motion by the rapidly revolving rotor which has the ventilating vanes on it, and consequently fire when started will be quickly swept around the exposed insulation.

The generators are totally encased with the exception of the air inlets and outlets, and even these in some designs are under the machines. This construction prevents access to a fire and much valuable time will necessarily be consumed before extinguishing agents can be used effectively. When the field current is cut off, as is necessary in case of short circuit, the only means of bringing the rotor quickly to rest is lost, and it will continue to run for a long time after the steam has been shut off. Some machines will run for over an hour. This continued rotation is not conducive to the quick extinguishing of fire, especially when the ventilating vanes are mounted on the rotor.

Current Rush With Short Circuit.

In addition to the possible causes of arcing existing in the case of the older types of generators, the turbo-generator is subject to momentary large current rush at instant of short circuit, even if the short is external to the machine itself, unless means are taken to keep the current within safe limits. The heavy rush of current causes mechanical stresses in the conductors, which in some cases are severe enough to distort the conductors, especially outside the slots, and to injure the insulating covering, resulting in a short circuit within the generator itself. In some designs, the internal reactance of the machines will permit of the momentary current rush amounting to 40, or possibly more, times the normal full-load current of the machines.

The possibility of the conductors being distorted has been reduced in some cases by designing generators with sufficient internal reactance, or by providing external reactance such that the current at the moment of short circuit will not be great enough to damage the generators. Attention has also been given to supporting the stator end connections to prevent their distortion. These means have undoubtedly greatly increased the safety of the turbo-type of generator from possibilities of internal short circuit, but in no way tend to prevent a fire resulting should an arc occur.

A short circuit in the rotor will probably not result in a severe fire unless under exceptional conditions. This is also true if the short circuit occurs inside of a stator slot. A short circuit involving a stator coil, however, is more apt to occur at the end of the slot where the conductors are exposed. Asbestos is now used largely for insulating the rotor windings, and as these windings are well protected, it is probable that only in cases of severe fire in a machine will the rotor windings be damaged to any extent.

Turbo-Generators a Recent Product.

While the generators may be free from fires during the earlier portions of their life owing to the proper use of reactances, which prevent external troubles seriously affecting the machines, as they get older, the ordinary causes of breakdown of insulation are liable to occur and fires result. Probably, in most cases generators will not be discarded until some trouble, usually in the nature of a short circuit, has occurred at least once in each, so that it is reasonable to expect that unless further preventative means are taken, turbo-generators stand a good chance of serious damage by fire at some time during their life. Although many fires have occurred, probably most of them have happened during the generator development stage. Generators of the turbo type are of such recent production that none of them has yet reached a life which could be considered old and, therefore, the troubles which can be expected near the end of their life by fire have still to come.

Minimizing the Chances of Fire.

Undoubtedly the manufacturing companies have given serious thought to the matter of the reduction of the fire hazard in turbo-generators and have employed all means practical at the present time to this end, but there is still very much to be desired. The following several means if taken together would seem to minimize the chances of a serious fire:

If a suitable material were found, a non-combustible outer covering could be placed over the insulation on the stator end connections. This would greatly delay the spread of fire, and, even if no other protective means were taken, would undoubtedly prevent much serious damage. Where fire extinguishers were used, the covering would at least hold back the fire until they could be brought into play. At present no material suitable for such a covering appears to be available.

If a non-combustible outer covering should be put on, its advantages would be partially lost in time unless the cooling air were freed of the dirt and oily vapor liable to be in it. This could be done by filtering, as has already been advocated several times.

Means could be provided for cutting off the air supply in case of fire in generators, by placing dampers in the inlet ducts, designed so as to be normally held open by fusing links. The links could be placed so that they would be quickly fused by the heat and allow the dampers to close automatically. By reducing the oxygen supply to that entering by leakage, the action of the fire would be slow.

Arrangements could be provided for the quick introduction of carbon dioxide gas into the machines. The carbon dioxide could be kept in liquid form and piped through valves, expansion tanks, etc., to the generators. The valves could be arranged to be opened by the closing of the air inlet dampers so that the gas would be automatically introduced into the generators. This gas would be very effective in extinguishing fires inside the machines after the air supply had been cut off.

The employment of some efficient method of reducing the fire hazard in generators of the turbo type either along the lines mentioned or in some other way is important. The value of these generators is great, and the damage by fire may amount to a considerable proportion of the first cost. It is probable that the damage is more liable to occur towards the end of the life of the generators, but even then the loss may be large, both directly and indirectly. The large central stations have reserve units so that the increased damage due to fire in one of their generators would probably not affect the continuity of service, but the increased time necessary for repairs may be long, and during this time, the reserve capacity will be weakened. In the case of industrial plants, the longer time needed for repairs might be serious. Many manufacturing concerns, who generate their own current, depend on only one unit and, therefore, their whole production, or a large part of it, would be affected.

REFRIGERATION DEPARTMENT

DIRECT EXPANSION vs. BRINE.

THE direct expansion of a refrigerating liquid or gas through piping directly in the space to be cooled has its advantages, and necessarily it has its disadvantages. The advocates of direct expansion sometimes forget its disadvantages and recommend it for all classes of cold storage and refrigerating work.

Brine circulation has advantages over direct expansion, and it has disadvantages, but generally speaking, the advantages of brine circulation preponderate so greatly, that brine is commonly recommended for general cold storage work. The advocates of brine circulation perhaps carry it a little too far, and sometimes do not favor the use of direct expansion for any purpose.

As between these two extremes, it may be stated that direct expansion is valuable for low temperature work, for quick cooling of warm products, and for the less sensitive classes of cold storage work. Brine circulation for comparatively high temperatures and for a nice control and adjustment of temperature cannot be compared with direct expansion. Therefore, brine circulation has its uses, and direct expansion also has its uses, but brine is best for most purposes.

THE IMPORTANCE OF INSULATION.*

By A. M. McCoy.

THE importance of insulation is often overlooked by many who embark in the ice and cold storage business. Many look upon it as an item of expense, while in fact it is an investment resulting in the very greatest economy in the operating expense. It materially reduces the cost of manufacturing and storage of ice, and without insulation the modern cold storage would be an impossibility.

Ordinary precaution is always used, but as a rule a plant is erected with as little insulation as possible, from the fact that the first cost seems to bluff the builder until he often uses three inches of insulation on rooms that should have four, and, in some instances, five inches. Many seem to figure that if they can possibly maintain their temperatures with a small amount of insulation, it is economy. This, however, is a mistake, as an increase in the thickness of the insulation on the walls, floors, ceilings and partitions of a room decreases the heat transmission to a minimum, and reduces the cost of maintaining temperatures accordingly.

Pertinent Example.

One of the largest ice, ice storage and precooling plants for refrigerator cars in the world, that of the Pacific Fruit Express Co. at Roseville, Cal., is an example. Their engineer figuring under the old method, arranged expansion surface sufficient to carry the temperatures required. He was, however, reluctantly won over to try the new method, and it proved so much more efficient that they were enabled to run with just one-third of their expansion surface in operation, the temperatures holding practically within a difference of two degrees when shut down from twelve to fourteen hours, and this with the house only partly filled with ice. They do not have any difficulty in maintaining temperatures as low as fifteen degrees. It is not necessary, however, to carry such a low temperature for the storage of ice, my information being that 24 degs. to 28 degs. F. is the ideal temperature of ice storage.

My advice is, if you are going to build a new plant, let the manufacturers of insulation attend to their part of the work in the latest and most approved manner, and no matter who you may deal with, universal satisfaction is sure to result. Almost any manufacturer will be willing to confer with you on this important item, and most of them can show the results they claim, although some may be a little overzealous in behalf of their own material.

When buying ice and refrigerating machinery, you seldom consult with the insulating people, nor should the ice machine people be burdened with the matter of insulation at time of selling you machinery, as the insulation is of as much importance as the machinery, and without insulation of the proper kind you will not be able to compete with the plant that has been properly constructed. This is said with all due respect to our mutual friends who sell the machinery and other equipments for your plant.

Insulating Materials.

There are many good kinds of insulating materials on the market, such as "Lith Board," "Linofelt," "Quilt," and th various kinds of cork board, granulated cork and mineral wool blocks, and there is some excuse for all of these materials, or they would not be so conspicuously on the market at this time. My further advice is that, if you have a poorly insulated plant, do not delay for another season, but call up the insulation man, the same as you would the doctor when you have sick folks at home, and let him prescribe the remedy for your plant.

I visited a plant in Des Moines, Iowa, about two years ago and found a man calling himself The Independent Ice Co., trying to manufacture ice without any insulation whatever. His tank was on the ground with a board fence around it, and when I tried to tell him the importance of insulation, he gave me a look that run my temperature below the freezing point, and said he had made ice before I was born, and had never used any insulation in his life, and never expected to, and that it was absolutely useless to talk to a man of his experience about something he knew all about. As I was leaving Des Moines that afternoon, I met the man who sold him the machinery, and he told me he had commenced foreclosure proceedings against the so-called Independent Ice Co,. as they were unable to meet their payments, and were unable to compete with manufacturers who had up-to-date insulation in their plants.

If you were coming down town some morning and you met a friend who told you that you were losing your money through a hole or leak in your pocket, you would immediately believe him and set about to remedy the cause without delay. So my advice is to allow the insulation man to show you how and why you are losing actual money every year through the leaks in the walls, floors and ceilings of your improperly insulated surfaces. The company that sells you an ice machine will not guarantee the capacity of the machine un-

*From a paper read before the Southwestern Ice Manufacturers Association.

less the tank is insulated according to their specifications, usually requiring four to six inches of cork board insulation under the tank and eight to ten inches of granulated cork or four to six inches of board insulaton around the outside, so that the brine can be held at a temperature of 10 to 15 degrees F., thereby enabling you to make ice with the least possible delay, and, as time means money, it is a saving to you.

If it is so important to insulate well the freezing tank, it is just as important that you have a properly insulated house to store the ice after it is made. Some plants of five to ten tons daily capacity often make and sell as much ice as a twenty to twenty-five ton plant by having suitable storage for ice and accumulating a good stock for the season's trade. The ice man who operates only in the ice season is obliged to install a much larger and very much more expensive plant to take care of his trade, and is unable to realize the profits his more fortunate competitor gets by having ice in storage for emergencies.

VALUE OF EFFICIENT ADVERTISING.

WE cannot say much more than we have already said along efficiency lines, but we can point to the fact that advertising changes the habits of the nation. We know it is not much understood, and it has been indicated here and elsewhere in the public prints that its importance is not appreciated. In a Senate report on the 'High Cost of Living,' eager to avoid the tariff and other things, they seized upon advertising as a scapegoat, to explain the increasing cost of living.

In the annual report of the leather company, we find that recently their affairs have not been prosperous and conditions were not good. They do not advertise; but referring to the packing companies, as large and as uncertain, and as dependent upon general conditions as the leather company, we find that owing to their advertised by-products, their profits have been conserved and they are paying a dividend.

By advertising we have made a clean nation. The soap publicity has changed the habits of the country. The constant picturing of the bath-tub has changed the nation in that respect, because we have trained the public ideal in the direction of bath rooms, sanitary, cleanly and wholesome surroundings.

A few years ago, in the average town of this country, the young man's ideal was to have a good horse, a buggy and a ten dollar whip; but his clothes were of secondary consideration. Then our tailors started picturing good looking, well-dressed young men around the town, and to-day they have changed the thoughts of young men everywhere, and they wear well recognized brands of clothing. their care in personal appearance has brought with it self-respect in other things. Advertising needs your fostering attention and development in the consideration of the efficiency movement. It is a power for good, a power for practical education and a power for industrial activity."

So writes Wm. H. Ingersoll in his paper on Advertising, which appears in the first volume of Transactions of the Efficiency Society, Inc., a volume containing matter of great value to all men, no matter what their life's work may be.

Owen Sound, Ont., C. A. S. E.—The above lodge met in Kilbourns Block on June 26, and appointed the following officers for the ensuing year: President. E. Hooey; first vice-president, P. J. Brillingar; second vice-president, D. Brillingar; secretary, W. J. Needham, 2089 3rd Avenue, East Owen Sound; treasurer, R. Walker; conductor, W. Knox; doorkeeper, F. Murray; trustees, J. F. Thompson; J. Robson and R. Walker. A fairly successful year is reported. The work in connection with the convention is, we understand, well under way, and the several committees report themselves to be in first-class shape with their arrangements, and promise a good time to visiting engineers. The hall for the exhibition is spacious and on the ground floor. The printing committee have spared no pains to secure a record-breaking souvenir.

READER, WHAT DO YOU KNOW?

Among readers of The Power House there is a clearly defined sincerity of desire to know how each overcomes the daily problems arising out of the care and operation of the power plant. It is believed that your methods of solving these are valuable, and can be made more so, if you publish them, so that other brains may help in the work. We will provide the setting and pay you for the material. When your fellow engineer puts the super-structure on your foundation, we pay him and pass the "kink" on to you, free. Get into the game.

Port Arthur, Ont., C. A. S. E.—On July 4, Lodge No. 29, C. A. S. E., Port Arthur, threw open its doors to members, their wives, sweethearts and friends, on the occasion of the installation of the officers for the ensuing year. After the ceremony, a choice program of music (both vocal and instrumental), recitations, speeches and step dancing was rendered. The floor was then cleared, and the company to the number of 75 enjoyed themselves dancing until midnight, when all sat down to a bountiful supper provided by the ladies, after which, dancing was renewed, and kept up until the wee sm' hours of the morning. The Lodge is especially grateful to Brothers Abraham Miller, Ivery, Wilson and Insley for the hard work they put in to make this, the first open meeting, the success it was. It is the first move towards a Ladies Auxiliary. The officers for the ensuing year are:—President, Fred Nagle; vice-president, J. MacFarlane; financial secretary, A. Miller; secretary, S. Smith; treasurer, J. H. Ivery; conductor, E. Miller; doorkeeper, R. Wilson; past president, J. Insley, who installed the officers. Fred Nagle was chosen as delegate to the C.A.S.E. Convention at Owen Sound at the end of this month.

BALL BEARING LINE SHAFTS.

EXPERIMENTS have recently been carried out in order to ascertain the exact saving in power effected in textile factories where the line shafts have been equipped with ball bearings throughout. These bearings were of a well-known make with two rows of balls in each, arranged to swivel bodily in their race. Electric power readings were taken under exactly similar conditions before and after the ordinary bearings had been replaced by ball bearings, and the result showed a saving of 30 horse-power at the engine in a weaving shed containing 900 looms. Had it been possible to eliminate the belt and rope friction, the actual percentage of saving of friction indicated in the bearings themselves would doubtless have been very considerable.

A test carried out on an edge-trimming machine shaft in a boot factory, the ordinary bearings in which had been replaced by an equal number of ball bearings, showed a saving of 80 per cent. in the power required to drive the shafting. It may be added that the speed of rotation does not affect the efficiency of ball bearings, and that the friction at starting is practically the same as when running. This is an important consideration in large factories where a fraction of a minute saved in running the machines up to speed after each stoppage will result in an appreciable increase in the total output from the machines.

GAS AND OIL ENGINE PROGRESS

A record of principles of design, construction and achievement in a rapidly developing sphere of power generation.

SOLID INJECTION FOR DIESEL ENGINES.

THE problem of injecting fuel without an air blast is one which has for some time past been occupying the minds of a large number of Diesel engine makers. When it is remembered that the air in the cylinder is compressed to about 600 or 700 lbs. to the square inch, and that the oil has to be injected at a still higher pressure, it will be understood that it is difficult to do this without the use of a powerful air compressing system. A three-stage air compressor means expense, additional weight and space. Compressed air is, of course, necessary for starting and manoeuvring purposes, but if the main compressor could be done away with, it would simplify the design and mean less complication. Already several devices have been patented to accomplish this end, and, in fact, there is a Continental Diesel engine in the market, in which the oil is injected into the cylinder in its liquid state.

One of these systems which deserves, perhaps, more than usual attention has been designed by Mr. James Kechnie, of Vickers, Ltd., and is made by the well-known Barrow firm, who, by the way, have given a deal of attention to experimenting in this direction. In this arrangement, the fuel is pumped at a high pressure into a tube, manufactured of a material which yields to the pressure of the oil, and on the opening of the injection valve, this tube contracts and forces the oil through the pulverizer into the cylinder. The pressure in the tube is, of course, greater than the pressure of the air in the cylinder, and the oil is sprayed into the cylinder in much the same way as it is injected by the use of compressed air on the present type of Diesel engine. The effect on the fuel consumption in this system is nil; in fact, in certain instances, there was a slight improvement.

To obtain a very high pressure, a grooved distance piece is inserted in the tube which prevents it contracting to its full extent. The result of this is that expansion does not commence until the pressure has risen to something like 2,500 lbs. per square inch. Whether this system is suitable for heavy oils, such as tar oils, is not yet known, but there is no reason, we can see, why it should not be applicable. Within the next few years, there will doubtlessly be many improvements made in Diesel engine design, and our own opinion is that improvement will be on the lines of increased simplicity, and that an effort will be made to perfect and popularize the solid injection Diesel.

DESIGN AND ECONOMY OF DIESEL ENGINES.

A PAPER on "The Design and Economy of Diesel Engines" was read at a recent meeting of the Association of Engineers-in-Charge by Capt. H. Riall Sankey. The author compared the cost of running Diesel engines with other prime movers, and pointed out that the condensing steam engine can, for short periods, give as much as 50 per cent. above the rated power, while non-condensing steam engines and the Diesel engine can give 10 per cent., but the gas engine can usually only do its rated power for short periods, and about 85 per cent. continuously. Taking the case where an average load of 200 horse power, and a maximum of 300 horse power for short periods is required, and the total running hours 3,000 per year, the following total annual costs were given:—Non-condensing steam plant, $7,225; condensing steam plant, $5,280; oil engine, $5,275; gas engine suction producer, $5,030; gas engine pressure producer, $4,980; Diesel engine, $4,660; overtype superheated condensing plant, $4,395. In this connection, interest on capital was taken at 5 per cent., and stores, labor, maintenance, repairs, and depreciation and fuel cost were taken into account. The costs per ton were taken as:—Oil, $10.25; coal for pressure producers, $4.50; coal for suction producers, $6.80; coal for steam boilers, $4.50. Only 120 tons of fuel are required for the Diesel engine, while 1,022 tons are required for the non-condensing steam plant.

BALANCING TURBO-ALTERNATORS.

ACCORDING to the Electrician, in United States factories, practically all turbo-alternators are balanced by a cut-and-dry process. The turbine is first assembled on the test floor, and connected to the steam and exhaust mains and to the oil and water systems of the plant. As the machine is driven under its own power, the test men determine which end of the machine is the worst by placing the forehead against the casing at different places. A weight is then inserted into one of the tapped holes provided in the rotor, and the machine is run up to speed and the result of the experiment is noted. If the vibrations are less violent but still noticeable, another and heavier weight may be inserted in the same hole. If the first attempt produces more violent vibrations, the weight is removed, and placed in some other part of the rotor.

Each tester generally has his own "follow-up scheme" of placing the successive weights. The process is continued until both ends of the turbine are free from vibration at the rated speed. When the generator is attached to the shaft, this process is repeated and weights are placed upon the ends of the rotor at various points on the circumference until all bearings and the casings of both the turbine and the generator are free from vibration as far as can be detected by placing the forehead against them. Many factories balance the rotors of their generators dynamically before they are assembled in the machine. Special apparatus fitted with delicate balancing mechanism is required for this work.

Leamington, Ont.—The Ruthven Cold Storage and Forwarding Co. have built a large plant here, and will start operations shortly.

The Coming C.A.S.E. Convention and Exhibition

Evidences are not wanting that the 24th annual convention of the Canadian Association of Stationary Engineers, together with the Allied Exhibition conducted by the Power Plant Supply men, will rival in their every feature the many joint and successful gatherings previously held.

THE Canadian Association of Stationary Engineers will hold its 24th Annual Convention at Owen Sound, Ont., on the 29th, 30th and 31st of the present month. The local lodge has spared neither time nor expense in their plans and arrangements for the reception and entertainment of the delegates and visitors, as a glance at the accompanying programme amply shows.

The Exhibitors' Association, too, have been particularly active in securing the placing on show of a large and varied assortment of power plant apparatus and supplies, and we feel justified in calling the attention of engineers generally, who can spare the time, to make it a point to embrace the opportunity of getting "next" to the latest developments in stationary steam engineering equipment.

Each succeeding Convention and Exhibition has aimed at, through its promoters, the eclipsing of its predecessor. and Owen Sound promises to be no exception.

First Day, July 29.

2 p.m.—Grand opening, in which all visitors, including ladies, will participate, in McLinden's Hall.

Mayor's address.

3 p.m.—Ladies will be taken by automobile to see points of interest.

Delegates in session.

President's address.

Appointment of committees, etc.

Secretary's report.

Treasurer's report.

General business.

3.30 p.m.—Banquet by Owen Sound Lodge, No. 25, at McLinden's Hall.

Second Day, July 30.

9 a.m.—General business and report of committees.

1.30 p.m.—Supply men's entertainment.

Boat to King's Royal Park.

Games and sport at King's Royal Band in attendance.

7.30 p.m.—Dance at King's Royal Hotel.

Third Day, July 31.

8.30 a.m.—General business.

9.30 a.m.—Election of officers.

Business Session C. A. S. E. Exhibitors' Association.

Auditor's report.

Unfinished business.

Installation of officers.

Adjournment.

The Exhibitors' Association have arranged an attractive programme of sports for the afternoon of Wednesday, July 30, and enquiries throughout the Province of Ontario, particularly, are sufficiently familiar with the versatility and resources of the Association Executive to know that "dull care" will have little scope to assert itself on that occasion.

At the dance on the same evening engineers and their guests will have the pleasure, at intervals, of listening to vocal and instrumental selections by Messrs. E. F. Hetherington, J. E. Fiddes and H. G. Fletcher, of the Goldie & McCulloch Co., the Standard Sanitary Mfg. Co., and the Garlock Packing Co. staffs, respectively.

C.A.S.E. EXHIBITORS' ASSOCIATION EXECUTIVE.

THE OPERATORS' VIEWPOINT

Devoted to brief descriptive article contributions covering ideas and experiences pertaining to power plant practice and operation. We pay for accepted material.

REGRINDING VALVE SEATS.

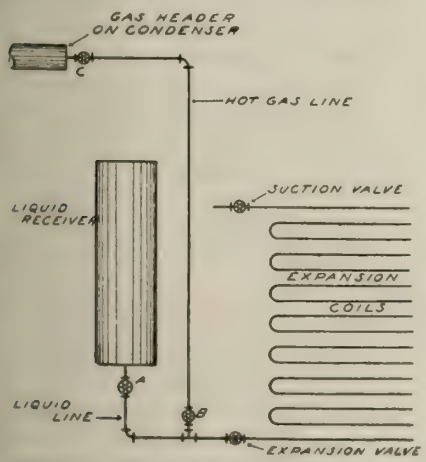
By E. E. Thompson.

PERHAPS you have some globe valves with composition discs that are leaking like a basket, because of a leaky seat. Remove the disc holder from the valve stem, cut out the composition disk, and fill up with emery mixed with just enough thin glue to make it damp. Smooth off the top while wet, and set away for a few hours. You will then have a nice little emery wheel which, if placed on the valve seat and turned with a brace, will be found a highly satisfactory regrinding appliance. The seat must be dry, else it will soften the glue. If you want to use the disc holder again in your valve, throw it in some warm water for a few minutes, and scrape the emery out with your old jack knife.

FROST ON REFRIGERATOR COILS.

By C. E. Anderson.

THE sketch shows an arrangement for melting frost from refrigerator pipes or expansion coils by means of hot gas from the ammonia compressor. It



DEVICE FOR MELTING FROST FROM REFRIGERATOR COILS.

consists of a one-inch line, with a valve at each end, running from the gas header of the condenser to any convenient point on the liquid line between the stop valve at the outlet of the receiver and the expansion valves.

To melt off a freezer with this arrangement, we first slow down the compressor, and then shut off the circulating water from the condenser in order to have the gas leave the condenser as hot as possible. We then open valves (B) and (C) and close valve (A); this allows hot gas to flow into the liquid line. We next close all of the expansion valves on the freezers excepting the valve on the freezer that is to be cleaned; this valve we open wide, and also close the suction valve on the freezer under treatment, until some of the hot gas has condensed in the expansion coils. We then open the suction valve slightly, so that the compressor will draw enough gas to keep it from running hot, and burning the rod packing. The quantity of suction gas can also be regulated by adjusting the stop valve on the suction side of the compressor. This, perhaps, is the better way, inasmuch as it permits of closer adjustment.

The freezers in our plant are of the dimensions 25 x 20 x 15 feet, and can be melted clear of frost in from 15 to 25 minutes. The temperature never rises more than three or four degrees during the operation, and this loss of cooling effect is quickly recovered when the liquid is again expanded in the coils, by reason of the clear surface of the coils permitting them to absorb a greater quantity of heat.—Penberthy Engineer and Fireman.

TO PROPERLY KEY A PULLEY.

IT is something of a trick to key a pulley so that it will not work loose after a time, especially if the pulley is large, and runs at a high rate of speed. In making the key, care must be taken that it be of uniform width, and fit the seat in the shaft and the pulley snugly. The key should be driven tight, but not so tight that it will kink under the blow. If the pulley runs with the hub against the box, which is the usual way, allow only about 1-32 in. end play between the box and the pulley.

When an old key is worn too thin, but fits properly otherwise, place a strip of tin under it to make it fill the keyway closely. To draw a key, a small end of which is projecting, hold it with a pair of pliers, pry against the hub of the pulley, at the same time driving the hub on the shaft with a hammer. This will loosen both the pulley and the key. If the key is cut off flush with the pulley, it may be necessary to remove the shaft and drive from the inside, in which case it is well to drive the pulley on a little, to loosen the key.

SAVING ELECTRIC LIGHT BILLS.

MR. F. E. OSGOOD, proprietor of the Osgood Hotel, Cookshire, Que., has devised an interesting means of saving electric light bills, and has had it in operation for several months now.

Like all hotel keepers, Mr. Osgood has experienced trouble with guests going away and leaving the electric lights burning in their rooms. Neither King's English nor good example would induce them to turn the switch off when they left, and to meet the situation, the hotelman had a placard posted in each room, which reads:

To My Guests.

God in His infinite goodness controls all things, but this electric light is now controlled by a meter. Please turn out the light when not in use and forever oblige,

Yours sincerely,

F. E. OSGOOD.

Comment on the unusual placard has been wide, but it has resulted in a material lessening of work for the meter, and a consequent reduction in the electric light bill.

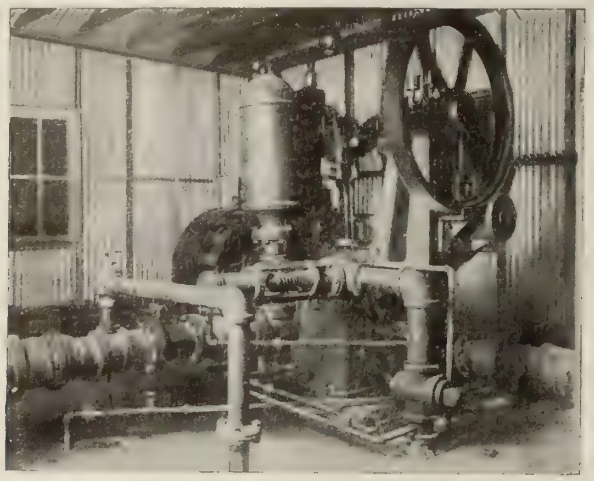
A PUMP WITHOUT AN ATTENDANT.

By A. G. W.

ONE of the important advantages of the electric motor for driving pumps is illustrated in the installation shown in the accompanying photograph. The pump is situated three miles from the power house it serves, and is started and stopped by an oil switch in the power house. No attendant ever goes near it except to give it a periodical in-

spection; hence its cost of operation is very low.

If desired, in such an installation, recording instruments can be placed in the power house to indicate how the pump is operating. Such instruments show whether the motor is running normally or not, and if the load is too high or too low, thereby giving notice when something is wrong. The power



A PUMP WITHOUT AN ATTENDANT.

house attendant can, therefore, give the outfit almost as careful attention as a man on the spot could give. It is convincing testimony, as to the reliability of the motor-driven pump, that such an outfit can be operated for years without trouble of any kind. This installation was made by the Lufkin Electric Light & Power Co., Lufkin, Texas. The pump is a Gould's triplex having a capacity of 350 gallons per minute, and is driven by a 2,200 volt, 50 h.p. Westinghouse motor. It operates against a head of about 130 lbs. and is equipped with a relief valve, so that it can be started against this pressure without injury.

SAFEGUARDING OVERHEAD TRANSMISSIONS.

By Fred. A. Barker.

OVERHEAD transmission is not as remote or as free from danger as we oftentimes are led to believe. It is true that many well-regulated factories have rules prohibiting persons from oiling or working on overhead transmission, while it is in motion, but these rules, good as they may be, cannot always be practically enforced. Belts will run off pulleys; and hangers, clutches, collars, couplings and bearings will get out of order. Intelligent care and close inspection are necessary, but unfortunately the practice is more often to look after machinery when it is in motion than when it is still.

*Reprinted from American Industries, April, 1913.

Platforms and Walks.

Guarding cannot be absolutely complete on overhead transmission; we, therefore, should endeavor to provide as safe means as possible in getting at the necessary parts. Platforms and oilers' walks should be conveniently placed along shafting wherever possible. These not only allow better opportunities for inspection, but are far safer than some portable means of getting at necessary points. Guard rails and toe boards should be provided on all such platforms.

Pulleys.

Ample space for belts should be allowed between two pulleys, or between pulley and hanger. Belt rests in the form of hooks can well be placed between pulleys or pulley and hanger, and will prevent the belt from wedging or resting on the revolving shaft. If two pulleys are very close together, and no such belt rest can be provided, the space between them can be filled up with a wooden pulley of the size of the regular pulleys, or of a smaller one of the two. Pulleys situated near hangers or other places requiring access can be guarded with stationary guards on the side and supported from overhead. Pulleys can also be webbed on the sides to prevent contact with spokes. Protruding set screws in the hubs of pulleys are a well-known source of danger and can be practically eliminated.

Horizontal and Idle Belts.

Long and high-speed overhead horizontal belts are oftentimes situated directly above persons working or passing underneath them. The breaking of such belts is liable to cause serious accidents. They can be effectively guarded with substantial and well-supported guards placed underneath. Great care, however, should be exercised to design such guards of sufficient strength, otherwise the additional danger is introduced of pulling the guards down with the belt. Guards are often made in the form of a channel in which the lower portion of the belt runs; this forms additional protection in preventing belts from running off pulleys.

Belts when removed from the driving pulley on shafting should never be allowed to hang loosely on the shaft; they may bind and wrap around the shaft with serious results. Idle belts often hang below in a dangerous manner to those nearby.

Shafting, Clutches, Collars, Couplings.

It is not practical, except in rare cases to cover shafting completely; however, points at which frequent access is necessary should be covered with guards of wood sheet metal, wire mesh, or such other special material as may be easily obtainable, depending upon the character of the shop. Protruding parts or clutches, couplings, and collars should be effectively covered or eliminated.

REVIVING A SMALL STORAGE BATTERY.

CHARGE the battery as rapidly as is possible to send current into it without overheating. The resistance being greatly increased by the effect of the sulphate, the cell will become hot when charging. Use a thermometer to test the temperature, and maintain the current at such a value that the temperature of the cell does not exceed 110 deg. F. Continue this charge until the plates begin to gas freely, then reduce the rate of charge to the normal rate and continue this until the plates again begin giving off gas. The rate of the charge should be reduced to half the normal rate, and continued until further gassing again occurs. The cell should then be partly discharged, and the treatment repeated. This cycle of operation may have to be carried on for some time.

WATER AND LIGHT PLANT, YELLOW GRASS, SASK.

THE following data concerning the Water and Light Plant at Yellow Grass, Saskatchewan, has been forwarded us by Mr. L. M. Smith, the manager.

In addition to a reservoir of 30,000 gallons capacity, there is an overhead tank of 12,000 gallons capacity, which enables sufficient pressure to be maintained, so that a stream of water may be thrown over the tallest of 5 elevators installed in the town. For domestic purposes, a flat rate of $1.00 per month is charged, while for hotels, restaurants, livery stables and large consumers generally, a classified rate is in force. The

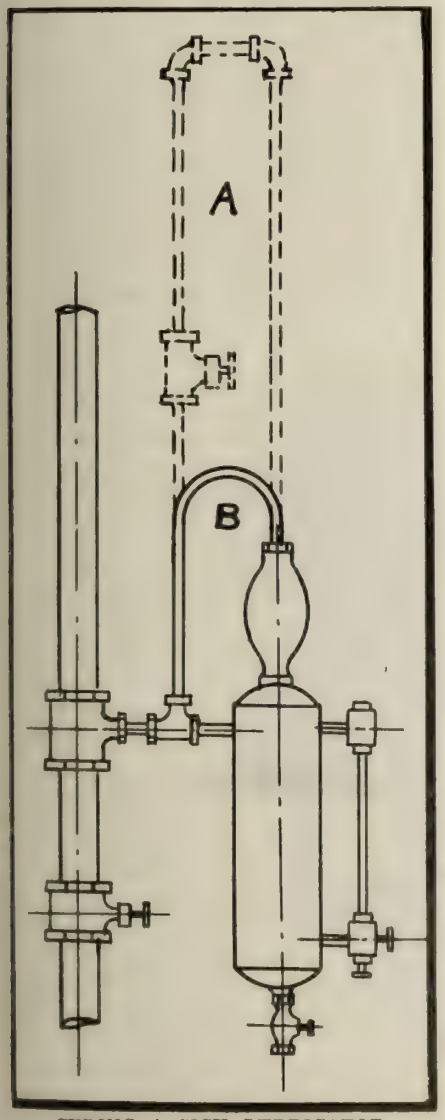
plant is self sustaining, the revenue for the year 1912 being $800.

The electric lighting equipment, which has been in operation for about two months, consists of the engine used for water pumping purposes, a Siemens D.C., shunt wound dynamo, and a storage battery equipment consisting of 60 cells, for 110 volts, 1,200 ampers, installed by the Accumulator Lighting Co., Winnipeg. The storage battery equipment is giving entire satisfaction and is unique from the fact of its being the largest in Saskatchewan province.

CURING A SICK LUBRICATOR.

By John Thorn.

SOMETIMES a lubricator, when piped as indicated by the full black lines in the sketch, gives trouble, and refuses to work properly. A scheme



CURING A SICK LUBRICATOR.

adopted to give reliable and efficient service consists in removing the bent pipe (B) and replacing it by piping (A), shown in dotted lines, at a height of about two feet from the top of the lubricator.

WHAT SHOULD A FIRST-CLASS OPERATOR KNOW.

By J. T. A.

THE answer by "Mechanic," in the June issue of the Power House to my article in the April number, overlooks most of the main points referred to by me. I stated that a man could have drafting and other knowledge, but unless he had several years' experience in steam power plant work he would not be a first-class engineer, or words to that effect. I further stated that a first-class engineer must know something about hydraulics, refrigeration, electricity, chemistry, drafting, condensers, steam heating, machine work, and so forth, and that no one man could be an expert in all of these. A man with these qualifications would certainly not be an ordinary engineer. The case referred to by "Mechanic," where a machinist told an engineer (so called) how he should handle a throttle governor is a very poor illustration, for the man was certainly not an engineer if he did not know how to do the simple piece of work mentioned, and no doubt the machinist had had experience with throttle valves, because 95 per cent. of ordinary machine shop operators would have known as little about throttle valves as did the "very much below the average" engineer mentioned.

The meaning I intended to convey to readers of my article should be easily understood from another point raised by "Mechanic." I stated that a third-class practical engineer has puzzled the non-practical draftsman many times on simple power house problems. A sentence can be separated from almost any article, and a different meaning given to it than would be taken when the complete article is considered, and I think I have a good "come-back" at "Mechanic" when he says that it is hardly fair to put up a dub machinist against an average smart engineer, yet, in the case of the throttle valve affair, he has certainly picked out the dub of all the dub engineers as an example. Even if the man in question had a second-class certificate, it would not count, for a certificate never made an engineer.

Another point I mentioned was that all examinations should be along sensible lines, and surely this would be better than along no sense lines. Of course, there may be a difference of opinion as to the meaning of the word "sensible." I said that questions asked dealing with chemistry, drafting, electricity and so forth should be those which an engineer would be most apt to know, or, in other words, use in his work, which surely is common sense.

At the present time there are many types of steam boilers, a long list of different steam engines and turbines, A.C. and D.C. electric machines, and a dozen or more different systems of steam heating. There are many different types of hydraulic elevators and electric elevators, different systems of mechanical refrigeration, and the extensive use of compressed air requires intricate machines in many cases. Pumps range from the plain duplex direct acting to high-duty triple expansion pumping machines with steam jackets and superheated steam. Again, there is the gas producer, a long list of internal combustion engines, and a hundred other things too well known to be detailed here. How under the sky is any one man ever going to learn more than a very little of a lot of these things. He may be right up to the minute in knowing the different Corliss engines and know next to nothing about the Brown engine. He might be right up top in hydraulic elevator lore and experience, and have had little or no experience with electric elevators. Perhaps the questions asked him by the examiner might be on the subject he had little experience with. This does not necessarily mean that he is not a first-class man.

No doubt he should be well up in mathematics, able to handle men, a total abstainer where liquor is concerned, and be a worker with his brain as well as his hands. I maintain that a man should be questioned by an examiner as to what apparatus he has handled. The man grown old in the business, with a lifetime of experience and study to his credit, can only know a very little about steam engineering, the main thing to get at being what he should know. It is absolutely impossible for a man to know it all, and those who claim otherwise are generally bluffers.

H. O. Edwards, advertising manager for the Canadian General Electric Co. and its subsidiary companies, has resigned, having accepted the position of sales manager with the Photo Engravers, Ltd., 70 Bond Street, Toronto. During his 12 years' service with the C. G. E. and subsidiaries he had charge of the general advertising, publication of catalogues and technical bulletins, as well as of the purchase of all office supplies. Mr. Edwards' ripe experience in the selection and buying of engravings should make his services extremely valuable to his new employers and their clients.

Practical Questions and Answers for Engineers

The present Q. and A. series from the N.E.L.A. Bulletin, consists of selected questions from power plant operators seeking information, and the replies thereto, by those of their confreres and others who are equally able and willing to oblige. We hope to supplement and widen the scope of this particular department in succeeding months.

Q.—Why is it that the starting torque of an alternating-current series motor is not as good as that of the direct-current series motor?

A.—The starting torque of a series alternating-current motor is less than that of a similar direct-current motor, principally because it becomes zero twice each cycle, instead of acting continuously.

* * *

Q.—Will a four-pole shunt motor operate satisfactorily with one of the shunt fields cut out?

A.—A 4-pole shunt motor with a multiple-path armature winding will not operate with one pole cut out, but will take such an excessive current that the armature will burn out if the machine is not properly fused. A motor with a series-path armature winding will operate, but the speed will be increased, and the unbalanced pull on the armature will probably cause the bearings to heat.

* * *

Q.—What is the highest voltage at which an alternating-current motor will work and give satisfactory results?

A.—The highest voltage used with success on syncronous alternating-current motors is 13,200 volts, and on induction alternating-current motors, 6,600 volts.

* * *

Q.—We are operating our system 2-phase, 3-wire, 60-cycles, 2,300 volts, load consisting of induction motors and lamps. If we change our generator to 3-phase, what objection would there be to operating the motors 2-phase, and balancing the load on the three phases, each motor using the same transformers that we now have in use?

A.—The disadvantage of operating in this way (assuming that there are taps on the transformers which will allow of the use of the Scott connection), is that the power-factor of the 3-phase circuit supplying the two transformers will be less than that of the motor.

* * *

Q.—What is the approximate cost per square foot of radiation for steam heating installation in a building, exclusive of boiler?

A.—Direct steam radiation set in place, but not connected, 20 cents per sq. ft. radiation; painting and bronzing radiators, 3 cents per sq. ft. radiation. Air valves on steam mains run about 50 cents a piece. For other angle and gate valves, take about 50 per cent. off the list price as cost. The pipe and fittings for a one-pipe steam job will cost approximately $7.00 per radiator. For a two-pipe steam job, the piping cost will be approximately $10 per radiator.

* * *

Q.—Why are some alternating-current generators rated in kilovolt-amperes instead of kilowatts, and what is tthe difference in meaning? Is there anything in print giving an explanation of the difference between these two ratings which can be used to instruct beginners?

A.—The capacity of a generator is determined by its temperature rise under load. The rise in temperature is a function of the current (amperes), and not necessarily of the power (watts), because, with a lagging power-factor, the current in the stator of a generator is greater than it would be with unity power-factor, the power output (watts load), remaining the same.

* * *

Q.—What are the relative efficiencies and life, cost of maintenance and initial cost of rubber and leather beltings? Which is the more suitable for high-speed work?

A.—Rubber belting is superior to leather belting in wet or steamy locations. Under normal favorable conditions, leather belting lasts longer, and will give cheaper service. The life of leather belting depends on the manner of its application. Mr. F. W. Taylor finds that when his rules for belting are followed, the life of leather belting will be more than twenty years.

* * *

Q.—What results have been obtained by using oil or tar for generating steam? Are they satisfactory? Please give the B. t. u. per pound, the gravity, the cost per gallon, where bought and all other available data.

A.—Using oil alone, the evaporation per pound of oil varies from 14 to 16 lb. from and at 212 degrees, and ratings of over 200 per cent. have been so attained. The oil costs $0.023 per gallon, the B.t.u. per pound ranging from 19,320 to 19,550, and the Baume gravity from 18½ to 19.

Q.—Why is exhaust steam so impracticable on a system designed for live steam operation, and vice versa?

A.—In exhaust steam operation, it is necessary to have pipes of larger size because of lower pressure is carried, due to the fact that there is a limit to the back pressure that would be carried on the engine. With live steam, the pressure can be carried high, and, therefore, smaller pipes may be used.

There are two difficulties which may be encountered in trying to operate with exhaust steam a heating system which has been designed for live-steam operation. First, there are many heating systems designed to operate on live steam which have not sufficient radiating surface to properly warm the building in extremely cold weather without raising the pressure to 10 or 15 lb. or more. This cannot ordinarily be done when exhaust steam is used; second, there are many heating systems poorly laid out or in bad repair which will not drain back the returns from all parts, unless a rather high pressure is carried. This second fault can usually be corrected by installing a vacuum pump. There should be no trouble in operating with live steam system designed for the use of exhaust steam.

AN ENGINE BREAKDOWN.

IN the March issue of "Vulcan" some interesting illustrations are given of an engine breakdown, brought about by the failure of a cast iron crank. The engine, originally of the simple beam condensing type, was built as far back as 1856, being afterwards compounded by fixing a vertical high-pressure cylinder to the opposite end of the crank shaft. The high-pressure cylinder was 21in. diameter by 4ft. stroke, and the low-pressure 33in. diameter by 6ft. stroke. The engine ran at 36 revolutions per minute, and drove the load by means of gearing. It had worked under these conditions for many years, but a little while ago commenced to give trouble on the high-pressure side, owing, in all probability, to a change in alignment caused by yielding of the foundations, connections, etc., and eventually the cast iron crank broke suddenly through the crank pin eye, smashing the high-pressure cylinder and numerous other parts. The illustrations showed that the broken crank was weakened to a great extent by a cotter hole for receiving the crank pin cotter, and on examination after the breakdown the metal showed signs of fatigue and gradual fracture.

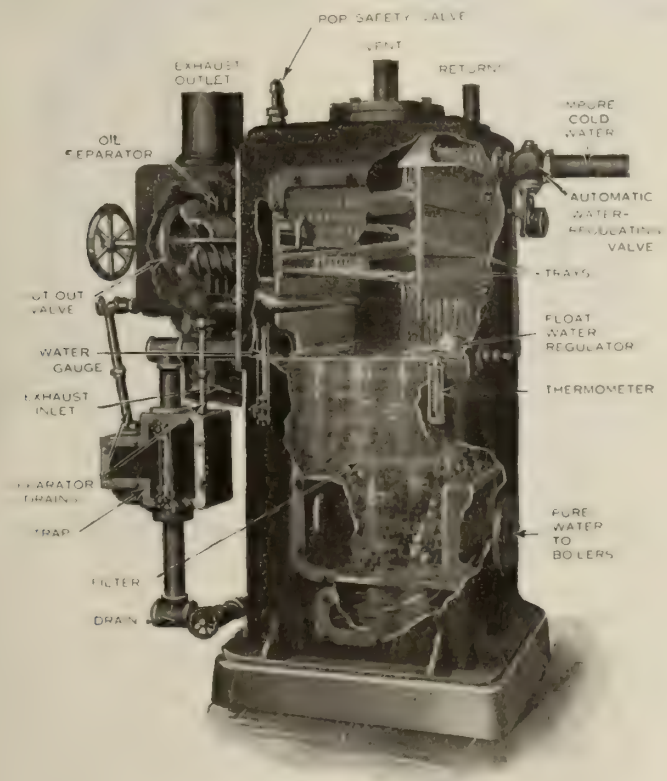
Atomization of Fuel Oil will proceed more readily if the oil is heated before being admitted to the burners.

PROGRESS IN NEW EQUIPMENT

There is here provided in compact form a monthly compendium of the power plant manufacturers' achievements.

NEW ONE-PIECE HEATER.

THE Bates Machine Co., Joliet, Ill., have placed on the market a new type Cookson one-piece heater. The substitution of a single casting for the customary built-up plate body does away with bolts and caulked joints at all points save the oil separator, the manhole and handhole covers, and the pipe fittings. In other words, there is no chance for leakage at the points which in any built-up heater are most apt to give trouble from this source. It is evident, too, that the more solid construction is practically indestructible and capable of safety withstanding the greatest back pressure that might ever build up within the heater. The steam space, tray surface and filtering space are large, and four large manholes and handholes make cleaning easy. The cleaning doors are conveniently located in front and back, and as the heater may be made right or left hand, by turning half way round, it will fit into the plant without complications in the piping.



NEW ONE PIECE HEATER.

The oil separator is made in either of two types:

(1)—Extra large and with cut-out valve, so that all the exhaust is treated. The surplus over feed water heating requirements is, therefore, in best possible condition for re-use in heating or processing systems, while the cut-out valve permits shutting off the body of the heater for cleaning, without interfering with the action of the oil separator.

II)—Standard oil separator which permits piping of the heater on thoroughfare or induction principle, and insures oil elimination from as much exhaust as is required for feed water heating.

A steam trap and return openings are provided so that the heater may receive the returns from a steam heating system or otherwise, as desired. The fittings throughout are high grade, and the flanges are furnished to meet customer's requirements.

MONSTER CHIMNEY.

A CHIMNEY of unprecedented size has been built at the smelter plant of the Boston and Montana Consolidated Copper and Silver Mining Co., near Great Falls, Montana. It is 506 ft. high above the top of the foundation ring, and 50 ft. in interior diameter at the top. It is the highest in the world by about 40 ft., and the highest in the United States by 140 ft., the Eastman Kodak chimney being 366 ft. high, and the Orford Copper Co. chimney being 365 feet. Its discharge capacity is 4,000,000 cubic feet of gases per minute. The draught expected is 3¾ in. water, with gases at 600 deg. Fah. average. The height was governed solely by the draught requirements, and not by the desideratum of discharging high enough in the air to prevent creation of a nuisance. This latter requirement is met by the existing stack, which is but 186 ft. high, the city of Great Falls being 500 ft. lower than the table land, and the valley being 250 ft. to 300 ft. lower.

BOVING & CO. OF CANADA, LTD.

THE business of the Canadian Boving Co. is now being operated under the title of Boving & Co., of Canada, Ltd., in order to bring it into line with that of the other branches of Boving & Co., Ltd., London, England, which are operating in Japan, New Zealand, Brazil, Mexico, etc. Owing also to the great increase in the volume of business, and to their having purchased the works of the Madison-Williams Manufacturing Co., of Lindsay, Ont., the capital of the company has been increased to $1,000,000, a portion of the first issue having been found in Canada. They are now in a position to turn out in their Canadian works the following machinery:—Water turbines, centrifugal pumps, pulp and paper making machinery, sawmill

machinery. Of the above, the centrifugal pumps have been hitherto made in England; the water turbines, pulp making and paper making machinery in Sweden; while the sawmill machinery has been manufactured by the Madison-Williams Co. in Lindsay.

The Canadian Boving Co. completed their first large plant in Canada in 1910, viz., water turbines of some 8,000 H.P. for the Calgary Power Co., and other important contracts which have since been executed are:—

City of Winnipeg—5 double horizontal open flume Francis turbines of 23,000 h.p.; and 2 double horizontal enclosed Francis turbines (exciters) of 900 h.p.

The Sydney Power Co., Trenton, Ont.—4 double vertical open flume Francis turbines of 6,000 h.p., and 4 double vertical open flume Francis turbines of 4,800 h.p.

Chicoutimi Pulp Co., Chicoutimi, Que.—2 double horizontal enclosed Francis turbines of 8,000 h.p.

Town of Farnham, Que.—2 double horizontal open flume Francis turbines of 1,130 h.p.

Town of Welland, Ont.—1 turbine of 250 h.p.

St. Francis Hydraulic Co., D'Israeli, Que.—1 double horizontal enclosed Francis turbine of 1,600 h.p.

Carillon Construction & Development Co.—1 turbine of 300 h.p.

City of Penticton—2 turbines of 380 h.p.

Ocean Falls Pulp Co.—6 single horizontal enclosed Francis turbines of 10,800 h.p.

Centrifugal Pumps.

Centrifugal pumps with capacities ranging from 220,000 to 54,000,000 gallons per 24 hours, and operating against heads of from 44 to 440 feet, have been supplied to and installed for the following municipalities, mining, and manufacturing concerns:—

City of Toronto, Nipissing Mining Co., Montreal Water & Power Co., City of Welland, Ont.; Delta Municipality, City of Moose Jaw, E. B. Eddy Co., Hull, Que.; City of Prince Albert, Town of Preston, Ont., etc. A considerable quantity of pulp making machinery has also been installed.

The experience gained during the past three years by the Canadian Boving Co. has enabled them to gauge the Canadian market, to familiarize themselves with what is actually required by and most suitable for that market, and by reason of their having let out contracts for various details of plants to Canadian firms they have been able to form an accurate idea of the cost of manufacturing such plants in the Dominion.

The Canadian company is working in close alliance with Boving & Co., Ltd., Union Court, Old Broad Street, London, England, to whose designs their machinery will be manufactured with such modifications as may be necessary to suit Canadian requirements.

Boving & Co. of London, England, have carried out some very large hydro-electric contracts, including work for:—

The British Aluminum Co., Ltd., London.

The Waihi Gold Mining Co., New Zealand.

Mt. Lyell Mining & Railway Co., Tasmania and London.

Hydro-Electric Power & Metallurgical Co., Tasmania.

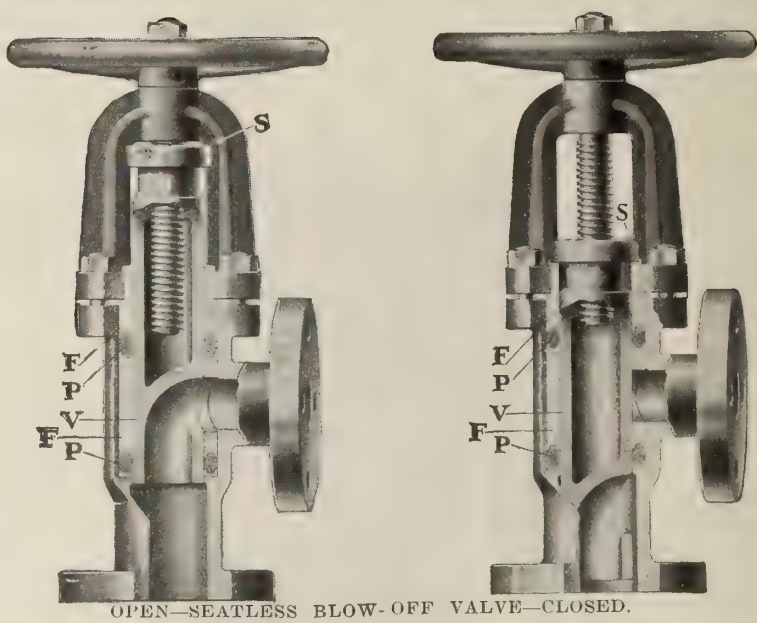
Kinguawa Hydro-Electric Co., Japan.

The City of Kyoto, Japan.

The Sagami Hydro-Electric Power Co., Japan.

The Governments of Western Australia, New Zealand, Egypt, Soudan, India and others, and the London County Council, while they are also on the Admiralty and the India Office list for the supply of hydraulic machinery.

The existing works are quite up to date, having been built in 1906. Large additions, however, will be made to them immediately, so that, in twelve months' time, the capacity will be about four times that of the present shops, and a number of new and up-to-date machine tools will be added so as to ensure the most accurate workmanship, as now required for modern machinery. Furthermore, they will be in a position to give prompt deliveries, and possibly improve on their prices, whilst maintaining the same high standard of efficiency and design which has always been their aim.



OPEN—SEATLESS BLOW-OFF VALVE—CLOSED.

A SEATLESS BLOW-OFF VALVE.

PROBABLY there is no valve in the plant that gives as much trouble as the blow-off, and when you consider the amount of grit and scale that has to pass over this valve seat every time the boiler is blown down, the only wonder is that it does not give more trouble than is usually experienced. It takes but a short time for a blow-off to dribble away five or ten dollars' worth of hot water once it begins to leak; besides this, the continual expense of regrinding or renewing valve seats has to be taken into consideration, to say nothing of the time and labor spent in trying to put it in something like serviceable condition.

Engineers have become so used to blow-off trouble, however, that they naturally look for it, and probably won't be happy without it in some cases. It is one of the necessary evils—so looked upon by engineers, because they can't see any way to remedy it. The thing that gives trouble is the valve seat, and the thing to be overcome is to eliminate the seat, and yet make a tight valve; one that will stay tight, not the first day, or week or month, but for years.

The simplex seatless blow-off valve is claimed to have successfully fulfilled these two requirements; and, as will be seen by the illustration, it is a very simple arrangement. No special directions are required for operating or cleaning, it being only necessary to operate the handwheel. In closing, shoulder (S) on plunger (V) engages loose follower gland (F), and compresses packing (P) above and below port, making an absolutely tight valve.

The Garlock Packing Co., Hamilton, Ont., are the Canadian distributors of this valve.

The Duty of a Pumping Engine is the foot-pounds of work which the engine does per one hundred pounds of coal consumed.

THE LOOSE NUT IN AN ELECTRIC SYSTEM.

By S. W. Worrall, M.Sc., M.E.

IT was recently remarked in the lay press that London could be thrown into darkness by a loose nut. While this in itself is rather an exaggerated statement, it is true that a loose nut may account for a great deal of trouble in an electric system. A case in point has recently come before the Vulcan Co., Manchester, England.

At a certain textile mill driven by three induction motors of the slip ring type, the power is supplied by a three-phase alternator, and the motors form the entire load. The largest motor, which is 175 h.p., gave considerable trouble at various times; at one time several rotor bars burnt out, while at another time the rotor bands were reported slack. These faults were repaired, and all went well until recently, when the trouble developed in a new way. The motor began to hunt on full load, and being the largest on the system, caused the pressure to fluctuate so violently that the no-volt release on the switch was liable to operate and cut the power off the motor. The other motors were also affected, and the entire mill was sometimes brought to a standstill. The only evidence that the large motor was the cause of the trouble was that, when it was not running, everything was quite normal. On half load the fluctuation was less violent and the mill could be kept running.

As the rotor had given trouble before, it was naturally assumed that something had again gone wrong with this part of the motor, and the makers were accordingly called in. The engineer sent could discover nothing wrong, and a second engineer attended. He carefully examined every part, tightened up and adjusted all the contacts and cables, and although he did not locate the seat of the trouble, the fault apparently disappeared. A few hours after he left, however, the fault again came into evidence, and as the motor was insured with the Vulcan Co., an urgent telegram was despatched by the owners of the mill requesting a special engineer to be sent.

Trouble Located.

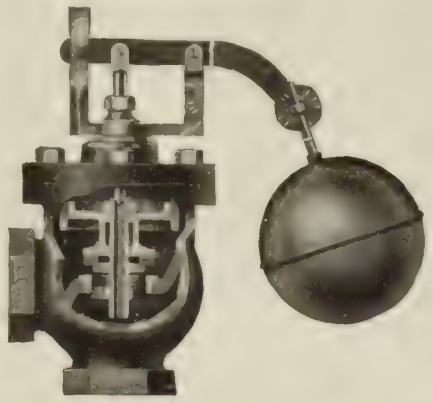
When the Vulcan Co.'s engineer reached the mill the motor was running on half load, and, without stopping it, a series of observations was made, which showed that the trouble was due to a high resistance in one phase of the rotor circuit. Step by step the fault was traced out, and eventually located to one of the running contacts of the rotor starting switch. The motor was not stopped, but was enabled to take full load by a temporary connection across the three rotor leads, thereby cutting out the starting switch altogether.

During the breakfast hour the slate front of the starting switch was drawn forward, and the suspected connection examined. The nut was found to be quite tight, and only very slight signs of overheating were visible. This connection had previously heated up, but at the time was quite cool.

Faulty Contact.

The observations made, however, left no doubt that the contact was at fault, and as the nuts would not yield to the spanner, they were driven off by hammer and chisel. The contact surfaces were so fused and oxidised that the circuit was practically broken, and the rotor was, therefore, running on two phases instead of three. A new part was made at a local brass foundry, and when fitted the motor took full load in a perfectly normal manner. The actual work was done in the meal hours, and during the working hours the mill was kept running on full load by the temporary connection described above. The faulty contact was very difficult of access, and could not be inspected without dismantling the switch. The screwed stud was about one-quarter inch too short, and the last nut was on the stud for only half its thickness, while the condition of the thread suggested that the nut had been first put on with the threads crossed, thereby becoming tight on the stud without making the contacts secure. If this be the correct explanation, the cause of the trouble had been present from the first, but until overheating was set up, with consequent oxidation and arcing of the contacts, no trouble was experienced.

A similar case occurred at another mill some little time ago; the speed variation being so bad that the quality of the manufactured product was seriously impaired. This time the trouble was caused by loose brushes on the contact arms of the rotor switch, and when these were tightened up the motor ran in a perfectly normal manner. The writer of the article is a member of the Vulcan Co. staff.



IMPROVED FLOAT VALVE.

IMPROVED FLOAT VALVE.

THE G. M. Davis Regulator Co., Chicago, have recently designed and put on the market an improved float valve, which is shown in the illustration. One of the principal features about this valve is that the seat and disc are so constructed that they can be readily renewed when signs of wear appear. The inner valve and cylinder of the iron body valves are sherardized and will not rust. The inner valve or disc is also semi-balanced, and has a hollow post. It is not connected to the stem, but is operated entirely by pressure. The stem, which is connected to the float by means of a lever, forms an auxiliary valve, which seats in the top of the hollow post of the disc. The pressure at the valve must be great enough to lift the actual weight of the disc. About three pounds is required for valves less than 6 inches, and about five pounds for the larger sizes. When this pressure is not available, a valve with a balanced disc can be furnished which does not require any pressure to operate it.

The top member of the disc is fitted loosely in the cylinder, which is part of the cover, so that the inlet pressure may leak by and accumulate in the chamber above the valve, where it is increased or decreased by means of the auxiliary valve, which closes when the float is raised by the water level, and opens when the level recedes. No leather cup packing is used, and there is no leakage from the top of the valve to run down over the body.

IMPROVING NOISY GEARING.

IN some of the large shops in St. Petersburg a simple method of lessening the noise of gearing has been found successful. For gears of less than 18 in. diameter, two sheets of tin are fitted, one on each side of the wheel, so as to box in the space between the rim and the boss, the sheets being screwed to the rim. The space between the sheets is filled with sawdust and No. 4 shot, to eliminate vibration. When the diameter of the gears is greater than 18 in., wooden rings are used instead of tin, attached in the same manner. A felt packing is used to prevent the sawdust leaking out. This arrangement reduces the amount of noise produced by the gearing, and by closing the spaces between the spokes of the whee lmakes it impossible for a workman to get his arms or tools caught.

POWER PLANT DEVELOPMENTS

A record of current municipal, manufacturing and general industrial projects, involving steam, gas, oil, electricity, air and water power equipment requirements.

Electrical

Brampton, Ont.—The electric lighting system will be extended.

Goderich, Ont.—The town council contemplates installing a lighting system for parks and bridges. Mayor, C. A. Reid.

Montreal, Que.—The management of the C.P.R. is preparing plans for electrification of its lines within 100 miles of Montreal.

Aurora, Ont.—The ratepayers voted against paying $26.29 for Hydro power, accepting the Toronto & York Radial Co 's offer at $25.50.

Yorkton, Sask.—The town asked the ratepayers on June 20 for permission to spend $140,000 on an extension to the electric plant.

Hamilton, Ont.—The Hydro-Electric department for four months this year shows a surplus of $2,523. The department has 3,859 customers.

London, Ont.—The London & Lake Erie Transportation Co. have refitted their old powerhouse, owing to interruptions in the Hydro-Electric service.

Tweed, Ont.—The municipality has entered into an agreement extending over 10 years with the Tweed Electric Light & Power Co., for the supply of power.

Toronto, Ont.—The Toronto Hydro-Electric Power Commission have practically decided to build a $1,000,000 auxiliary steam plant on the water front.

Hamilton, Ont.—Engineer Sifton of the Hydro Board, will purchase arc lamps for city lighting. An arc lamp invented by the American Westinghouse Co is being considered.

Toronto, Ont.—There is talk of the Ontario Hydro-Electric Commission building a second transmission line between Hamilton and Dundas, capable of transmitting 10,000 volts.

Hamilton, Ont.—The Canadian Westinghouse Co. recently supplied another 10,000 k.w. generator to the Canadian Niagara Falls Power Co. It is similar to those previously installed.

Hamilton, Ont.—Mayor Allan is in favor of building a transformer station on the Beach, through which to pass Toronto and Niagara Power Company's current, in case of trouble on the Hydro lines.

Montreal, Que.—McCuaig Bros. & Co., who contemplate the erection of a large generating plant, have interviewed the civic officials of Granby, Que., with the object of disposing of 2,000 horsepower there.

Berlin, Ont.—The City Council have passed by-laws for the expenditure of $85,300 for a trunk sewer, $25,000 for gas extensions, $35,000 for electric extensions, and the rest for local improvements.

Victoria, B.C.—With the completion next month of a dam being built by the British Columbia Electric Co. at Jordan River, in connection with an increase of power development at its plant, 14,000 h.p. will be developed.

Winnipeg, Man.—The terminal power station on Rover Street is to be enlarged; contractors, the Fort Garry Construction Co., Winnipeg. The price is $35,800. New equipment will consist of transformers and switching apparatus.

Medicine Hat, Alta.—It is proposed to electrify the spur, six miles long, running to Ainsley Mine and serving several industrial sites, and arrange with the street railway company to operate motors thereon to do switching for industries.

Toronto, Ont.—The Hydro-Electric Commission will build a transmission line to Morrisburg and Eastern Ontario, 40 miles long, with branches. It will carry 22,000 volts. Power may be obtained from an American company on the St. Lawrence river.

Peterborough, Ont. — The Canadian General Electric Co. will erect two new factory buildings here, costing $7,000 each. There will be one one-story building, 52x127 ft., and one two-story structure, 68x200 ft. The construction will be of brick, concrete foundation.

Hamilton, Ont.—Complaint was made to the Board of Control recently by City Engineer Macallum that Hydro-Electric power was off from 3 o'clock until 10 o'clock. There was some discussion as to the best method of furnishing an auxiliary service for the waterworks pumps, and the matter was left in the hands of Controller Cooper.

Vancouver, B.C.—The Pacific Great Eastern Railway Co., contemplates electrifying their line; and the Bridge River Co., recently incorporated, will develop 200,000 h.p. in the Lliollette district at a cost of $8,000,000, to supply the power. A dam will be built on the Bridge River, and a tunnel, 1¾ miles long, driven through the mountain.

Toronto, Ont.—The Toronto Electric Light Co. have been awarded a permit to build a $12,000 sub-station on the Esplanade in which they will use turbo equipment. R. J. Fleming says nothing about their plans, but it is believed this is a steam reserve for the system, and that expensive equipment will be purchased.

Berlin, Ont.—The light commission has instructed Superintendent McIntyre to secure an estimate of the cost of changing the old producer gas engine now out of commission to a modern one, and have it connected with electric generators. It is estimated that sufficient power can be developed by this change to operate the street railway service during hydro interruptions.

Montreal, Que.—It was announced this week by Edwin Hanson, president of Montreal Water & Power Co., that the new proposition for sale of St. Henry Plant to the city would be placed in the hands of the city within a day or two. Mr. Hanson explained the delay has been caused by the fact that most of the papers and documents of the company were held in England. It had also

been necessary to examine conditions in other cities where plants of this kind were taken over by the corporations.

Toronto, Ont.—Engineer H. H. Couzens of the Toronto Hydro-Electric system is advocating the construction of a steam reserve plant in order to insure an uninterrupted power service to manufacturers in the event of another breakdown in the Hydro transmission system.

If his recommendation is adopted a contemplated cut in rates cannot be made.

Water Works

Mount Dennis, Ont.—The ratepayers are urging incorporation to allow them to construct a waterworks system.

Hespeler, Ont.—The village Council may erect waterworks with three miles of mains. Clerk, Winfield Brewster.

Orillia, Ont.—The ratepayers have voted against spending $58,000 on extensions to the waterworks system.

Winnipeg, Man.—Excavating machines will be used largely in the construction of the waterworks plant and conduit which will be built to supply the city with water from Shoal Lake.

Hamilton, Ont.—Owing to the poor showing of the steam pumps during the recent breakdown in the Hydro-Electric system, it is probable the city will call for tenders for new pumps before long.

Sault Ste. Marie, Ont.—The city will have to arrange soon for a civic water supply. It will probably take over the Tagona Water and Light Co. plant and operate it. The lighting system may also be taken over by the city.

Calgary, Alta.—A. W. Ellson Fawkes, waterworks engineer, invites proposals for a 2 ft. 4 in. railway, 2 dinkie engines and 12 cars, for carrying mains along route to source of water supply, 45 miles away.

Contracts Awarded

Point Claire, Que.—Laurin & Leitch, Montreal, have secured the contract for building the electric lighting plant here.

Yorkton, Sask.—Ritchie & Watters have been awarded the contract for the erection of the power station. The contract price is $36,557.

Moose Jaw, Sask.—The city has awarded the firm of Willans & Robinson the contract for the installation of a new 1,500 k.w. turbo generator for the power house.

South Vancouver, B.C.—The British Columbia Equipment Co. has been awarded a contract for the construction of a 750,000 gallon steel standpipe at $30,000 by the City Council.

Montreal, Que.—The Board of Control has granted a contract for widening the city aqueduct to the Cook Construction Co., of Sudbury, Ont., the lowest tenderer. Their price is $2,322,552.

Regina, Sask.—Parsons Construction and Engineering Co. are erecting an incinerator building for the city, and the Decarie Incinerator Co., Minneapolis, Minn., will supply the incinerator plant.

Edmonton, Alta.—The city has awarded the contract for building the filtration plant to the New York Continental Jewell Co. for $117,000, to be completed April 15, 1914. The contract for sewage pumps went to W. H. Allen, Son & Co., Bedford, England, for $1,960.

Strassburg, Sask.—The British Canadian Engineering Supply Co., of Winnipeg, has been awarded the contract for supplying the town with one 50 h.p. Ruston-Proctor gas producer and engine, and the Canadian General Electric Co., the contract for 37½ k.v.a. generator, exciter, etc..

Trade Gossip

The Erindale Power Co.and The Interurban Electric Co. are at law over $93,000 which the former claims from the latter for power alleged to have been supplied.

Convention of Boiler Manufacturers.—The twenty-fifth annual convention of the American Boiler Manufacturers' Association of the United States and Canada will be held in Cleveland, Ohio, on September 2, 3, 4, and 5, 1913.

Goulds Pump Co., of Canada.—The business of the Goulds Pump Co., of Canada, Ltd., is now being carried on under the name of the Storey Pump and Equipment Co., Ltd. The present offices at Montreal and Toronto, and the personnel of the Company have not undergone any change.

The Siemens Company of Canada has received repeat orders for two further 22,000 volt. feeder equipments, each of 2,500 K.V.A., for the Hydro-Electric sub-station at Port Arthur, Ont. They have carried out the complete electrical equipment of this station, which include the following apparatus:—Seven 750 K.V.A., 22,000 volt. transformers; a 20-panel switchboard; lightning arresters, and two 750 h.p. motor generators.

The Canadian General Electric Co., Toronto, have sent us copies of Bulletins Nos. 42 and 4110. The former contains a description of the "Blaisdell" duplex air compressor, and the latter gives a wealth of interesting information regarding cloth pinions. It is claimed these pinions are noiseless, are not affected by oil, extremes of temperature or climatic conditions, and are very durable. Bulletin 4110 also contains many useful tables on gearing. Copies will be gladly sent on request.

The Perolin Co. of Canada, Ltd., w. s recently incorporated in this country as sole distributors in Canada of Perolin, a mechanical treatment for boiler scale, pitting and corrosion. It has been used in Europe for eighteen years under the name of S. R. Sampf-Keffel-Meschung, and Old Country engineers in Canada will remember it by that name. When injected into the boiler Perolin forces its way through the cracks in the scale and breaks it down; the Perolin remains and prevents further encrustation. Headquarters are in the Standard Bank Building, Toronto, and some well known Toronto business men are on the directorate.

The Smart-Turner Machine Co., Hamilton, Ont., are supplying the following machinery:—The Toronto Power Co., Burlington, Ont., one centrifugal pump; Price Bros. & Co., Kanogani, Que., one centrifugal pump; J. J. Drummond, Creemore, Ont., one centrifugal pump; The Page Hersey Iron, Tube & Lead Co., Toronto, one centrifugal pump; The Dominion Abattoir Co., Toronto, Ont., one triplex power pump; The Thunder Bay Contracting Co., Port Arthur, Ont., one steam engine driven centrifugal pump; Perth Ave. School, Toronto, Ont., one automatic feed pump and receiver equipment; The Savoie Guay Co., Plessisville Station, Ont., one standard Duplex pump; The R. & O. Navigation Co. steamer "Belleville," one duplex packed piston pump.

The Chapman Engine and Mfg. Co., Dundas, Ont., have begun the manufacture of small size gasoline engines and well drilling machinery. Operations were commenced two years ago in a disused cotton factory, which has been converted into an up-to-date engineering plant, with first-class machine tool and other equipment. Up till last summer they purchased the castings for their engines outside, but have now a foundry with a 56 inch Calumet cupola, made in Harvey, Ill. Moulding is done both on bench and floor, and eventually moulding machines will be employed. Besides the machine shop and foundry, there is a pattern shop, core room, with testing, assembling and painting department. Ample room is allowed for expansion, which should take place before long, as developments are being planned.

About a hundred men are employed. Steam is supplied by a boiler made by Goldie & McCulloch, Galt, Ont.

The International Engineering Works, Ltd., Amherst, N.S., have recently sold return tubular boilers to the following companies:—C. W. Church, Falmouth, N.S., 50 h.p.; Amherst Pianos, Ltd., Amherst, N.S., 110 h.p.; R. H. Williams, Regina, Sask., three 110 h.p.; Grant Bros., Calgary, Alta., 65 h.p. Robb portable boilers have also been recently sold to A. C. Higgs, Nappan, N.S.; C. O. Black, Oxford, N.S., and McGillivray Creek Coal & Coke Co., Calgary, Alta. The Canadian Westinghouse Co., Hamilton, Ont., have recently purchased three engines from the International Engineering Works, Ltd., for direct-connection to alternating current generators for the Canadian Pacific Railway, and the Canadian Explosives, Ltd., Montreal, Que., are to install two 14 in. by 18 in. Robb Corliss engines direct-connected to 125 K.V.A. electric generators.

Refrigeration

Moose Jaw, Sask.—H. F. Mooers, president of the Moose Jaw Cold Storage Co., is arranging to add an ice making plant.

Toronto, Ont.—H. Arnold has had his meat market equipped with a 6-ton "York" refrigerating plant by the Kent Co., Ltd., Montreal, Que.

Toronto, Ont.—An 8-ton "York" refrigerating plant is being installed in R. R. Bullen's apartment house by the Kent Co., Ltd., Montreal, Que.

Saskatoon, Sask.—The Saskatchewan Abattoirs, Ltd., has been organized and will build an abattoir and cold storage plant to cost about $100,000 or over.

Toronto, Ont.—The Harris Abattoir Co. is adding to its equipment an 18-ton refrigerating plant, furnished by the Vilter Mfg. Co., Milwaukee, Wis.

Montreal, Que.—The University Club is adding to its equipment a 2-ton refrigerating machine, furnished by the Linde-Canadian Refrigeration Co., Montreal.

Toronto, Ont.—The T. English Co. have had installed in their dairy by the Kent Co., Ltd., a 6-ton vertical, single-acting belt-driven "York" refrigerating plant.

Calgary, Alta.—The Crystal Ice has completed arrangements for the construction of a large ice making plant and artificial ice skating rink, to be erected shortly.

Chase, B. C.—The Kamloops-Vancouver Meat Co. contemplate building a modern packing house here, to be equipped with refrigerating and ice making plant.

Cumberland, B. C.—The Comox Co-operative Society is installing a 1½-ton refrigerating plant, contract for which was let to the Armstrong Machinery Co., Spokane, Wash.

Port Edward, B. C.—The British Columbia Fisheries Co., of Vancouver, contemplate building a fish freezing and storage plant at Port Edward, to cost about $400,000.

Butedale, Work Island, B. C.—John Wallace is erecting a cold storage warehouse in connection with his fish cannery, and will equip same with a 40-ton refrigerating plant.

Sarnia, Ont.—The Mackenzie Electric Co. has had its office building equipped with a 1-ton belt driven refrigerating plant, furnished by the York Manufacturing Co., York, Pa.

Winnipeg, Man.—The Board of Control of the Municipal Hospitals is letting contracts for the installation of a refrigerating plant in the municipal hospital on Morley Avenue.

South Fort George, B. C.—P. Burns Co., Ltd., Calgary, Alta., have completed arrangements for construction of their proposed meat packing and cold storage plant, at South Fort George.

Prince Albert, Sask.—The Prince Albert Creamery Co. are equipping their creamery with a 17-ton refrigerating plant, contract for which was let to the Creamery Packing Mfg. Co., DeKalb, Ill.

Vancouver, B.C.—The Mainland Ice & Cold Storage Co. is having plans prepared for a new cold storage plant, four storeys, of mill construction. Estimated cost, $150,000. Gould & Wood, Vancouver, B.C., architects.

Vancouver, B. C.—The Mainland Ice & Cold Storage Co. are having plans made for a new 4-storey cold storage warehouse to be erected at Nelson and Gamble Streets at a cost of about $150,000.

Montreal, Que.—The Montreal Y. M. C. A. is having the provision boxes in its building equipped with a 2-ton refrigerating plant, furnished by the Linde-Canadian Refrigerating Co., Montreal.

Toronto, Ont.—The Wellsboro apartment building is being equipped with a 10-ton refrigerating plant for cooling refrigerators, machinery being furnished by the Creamery Package Mfg Co., DeKalb, Ill.

Winnipeg, Man.—The Manitoba Cold Storage Co., Ltd., is having installed in its new cold storage warehouse a 300-ton refrigerating plant, contract for which was let to the Vilter Mfg. Co., Milwaukee, Wis.

Winnipeg, Man.—McDonagh & Shea, brewers, are having installed a 100-ton refrigerating machine, driven by 150-h. p. motor, together with condensers, etc., all furnished by the Linde-Canadian Refrigeration Co., Montreal.

London, Ont.—The McCormick Mfg. Co. are having installed in their candy factory a 60-ton motor driven refrigerating plant for cooling, dipping and storage rooms. The machinery is being furnished by the Linde-Canadian Refrigerating Co., Montreal.

Montreal, Que.—The Montreal Dairy is to be equipped with a 40-ton motor driven refrigerating machine for cooling storage rooms, freezing and hardening ice cream. The machinery is being supplied by the Linde-Canadian Refrigeration Co., Montreal.

Vancouver, B. C.—The Canadian Breweries are improving the refrigerating plant in their new Vancouver Brewery by the addition of a 100-ton surface condenser, and about 12,000 feet of 2-inch direct expansion piping, fittings, etc., all furnished by the Linde-Canadian Refrigeration Co., Montreal.

Calgary, Alta.—The Calgary Hotel, the property of the Canadian Pacific Railway, is being equipped with two 25-ton motor driven refrigerating machines, complete, with brine coolers, brine pipes, ice cream freezing system, etc., and also a 2-ton ice making system. The machinery is being furnished by the Linde-Canadian Refrigeration Co., Montreal.

Tenders

Winnipeg, Man.—The Board of Control is in the market for a 1,000 K. W. motor generator, tenders for which will be received by M. Peterson, secretary, up to August 9.

Saskatoon, Sask.—Tenders for a motor service truck for the fire department will be received by the chairman of the commissioners up to July 31. F. E. Harrison, Mayor.

Toronto, Ont.—Tenders will be received by registered post by the Board of Control up to July 29 for the supply of portable sewage pumping engines. H. C. Hocken, Mayor.

SIEMENS BROS. DYNAMO WORKS | SIEMENS BROS. & CO.

SIEMENS

SIEMEN'S - SCHUCKERTWERKE | SIEMENS & HALSKE

Siemens 750 K.W. Direct Current 550 Volt Generator Supplied to the City of Edmonton.

Amongst other generators supplied or on order for Canada, the following may be mentioned :—

1—4,000 K.W. Edmonton.	1—800 K.W. Canadian Collieries.	2—500 K.W. Winnipeg.
1—2,500 K.W. Dominion Coal Co.	1—800 K.W. Dominion Coal Co.	2—500 K.W. Port Arthur.
1—2,000 K.W. Edmonton.	2—750 K.W. Medicine Hat.	2—500 K.W. N.S. Steel & Coal Co.
3—2,000 K.W. Dawson City	1—750 K.W. Edmonton.	2—400 K.W. Regina.
2—1,500 K.W. Regina.	1—750 K.W. N.S. Steel & Coal Co.	1—400 K.W. Lethbridge.
1—1,500 K.W. Lethbridge.	1—700 K.W. Canadian Collieries.	1—400 K.W. Yorkton.

The Siemens Company undertakes the complete equipment of electrical plant of every description and substations up to 110,000 volts.

Siemens Company of Canada, Limited

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Transportation Building - MONTREAL

BRANCH OFFICES :

STANDARD BANK BUILDING
TORONTO

McARTHUR BUILDING
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New Incorporations

Kipawa Power Co., Ltd., incorporated at Ottawa, capital $1,000,000, to generate electricity at Toronto.

Radio Electric Co., of Canada, Ltd., incorporated at Ottawa, capital $200,000, to manufacture telephones and telegraph apparatus at Montreal.

Transcontinental Power Corporation, Ltd., incorporated at Ottawa, capital $10,000, to distribute electrical energy or any other power or force in Toronto.

London Asbestos and Supply Co., Ltd., incorporated at Toronto, capital $25,000, to buy and sell asbestos at London. Incorporators: John Putherbough, Thos. L. Partridge, etc., London.

Armstrong Cork Co.—Notice of the incorporation of the Armstrong Cork Co., Ltd., appears in The Canada Gazette. The company is capitalized at $100,000, with headquarters at Toronto. Among the incorporators are W. A. J. Case, solicitor, James B. Taylor and George C. Loveys, accountants, all of Toronto.

Personal

George Butcher, superintendent of Darling Bros., Ltd., Ottawa Street, Montreal, has gone on a brief holiday.

A. N. Beer, a Montreal C. P. R. engineer has been recommended for the position of assistant city water works engineer for Ottawa, at a salary of $2,500 a year.

A. C. D. Blanchard, city engineer of Lethbridge, Alta., has resigned. He has held the position for two years. Before accepting another position he will take a trip to Europe.

John W. Ritchie, formerly of Orillia, Ont., chief operator of the Mississippi River Power Distributing Co., St. Louis, Mo., was electrocuted on June 28th, at the company's plant.

John Ankers has been appointed by the New Westminster, B.C., City Council to the position of waterworks superintendent. He was for twenty years pipe line inspector for the city.

E. A. Schofield, of the firm of Jones & Glassco, Montreal, was married on May 31st to Miss Leonard, daughter of Mr. F. E. Leonard, of the firm of E. Leonard & Sons, Limited, London, Ont.

John S. MacLean has been appointed to take charge of the publicity and advertising work of the Canadian General Electric Co., Ltd., and of the Canadian Allis-Chalmers, Ltd., with headquarters in Toronto. The latter Company, in addition to manufacturing an extensive line of machinery and appliances, will also act as sales agents for all the products of the Canada Foundry Co., Ltd. Mr. MacLean held a similar position with Allis-Chalmers-Bullock, Ltd., for a number of years.

Oliver W. Hull, formerly associated with the Hitchcock Publications of Chicago as Western advertising manager, has joined the Chamberlin Company—Technical Publicity—of Detroit. Mr. Hull is well and favorably known in machinery circles throughout the Middle West. His wide knowledge of manufacturing and selling problems in the field in which the Chamberlin Company is engaged, will undoubtedly prove a valuable acquisition to an already large and rapidly growing force of men doing rather unusual things.

Arthur S. Herbert has resigned his position as general manager of the Siemens Co., of Canada, and has been appointed general manager of the branch offices of the Siemens Co. in Australia. Mr. Herbert is now in England, but will return to Canada for a few weeks early next month, sailing for Australia from Vancouver about the end of August. He will be succeeded in Canada by Mr. C. A. Ablett, whose name has been closely associated with the electrification of rolling mills in Europe during the past few years, and who recently made a brief investigation of the position of the large steel works of Canada with regard to electric drive. Mr. Ablett will take up his duties in Canada at the beginning of next month, but the appointment dates from June 1.

D. A. Street, Ottawa, was elected president of the Canadian Electrical Association for the coming year at their annual convention at Toronto on Friday, June 27. The following other officers were elected:—first vice-president, A. L. Mudge, Toronto; second vice-president, B. H. McDougall, Toronto; third vice-president, W. Maclachlan, Trenton; honorary secretary, T. S. Young, Toronto; secretary-treasurer, H. T. Martin, Toronto; managing committee, A. A. Dion, Ottawa; J. S. Goulds, Smiths Falls; F. G. Clarke, Toronto; L. Clark, Hamilton; R. S. McDunnough, Three Rivers; H. G. Matthews, Quebec; E. L. Milliken, Sydney; W. L. Bird, Fort William; W. S. Robertson, Toronto; A. G. Dunlop, Peterboro'; R. M. Wilson, Montreal; R. H. Sperling, Vancouver; R. J. Smith, Perth; W. G. Angus, Hamilton.

Miscellaneous

Port Coquitlam, B.C.—The fire chief will recommend that the city purchase a motor truck and hose for adequate fire protection.

Oil for Diesel Engines.—Generally speaking, the oil for use in a semi-Diesel engine needs to be slightly lighter than in a Diesel engine," says The Times Engineering Supplement. Care must be exercised in judging the claims of a particular engine to run on a specially heavy oil, as such claims are very often based on the fact that the engine has run satisfactorily in that particular oil when used intermittently with another and lighter oil. The performance, therefore, of engines of the Diesel and semi-Diesel type in regard to fuel should only be judged by their performance on long runs, the use of an oil above 0-9 specific gravity generally necessitating very frequent cleaning. which nullifies the advantages gained by the employment of a cheaper grade of fuel.

Obituary

George Henry Eaton, assistant master car builder of the C.P.R. Western lines, died on June 30, aged 53. He had held responsible positions in Toronto, Montreal and Farnham.

M. J. Power, general storekeeper of the C.P.R., died July 4 at the Royal Victoria Hospital, Montreal, after an illness of fourteen weeks. A. A. Goodchild has been appointed his successor.

Samuel Lyon Moyer, First Vice-President of the Lunkenheimer Co., Cincinnati, Ohio, died recently after a protracted illness arising from stomach affection. Mr. Moyer, was born in Cincinnati on August 17, 1874. Sam, as he was known to his host of friends, was a pupil of the First Intermediate School, and later attended the Woodward High School, from which he graduated. He had been connected with the Lunkenheimer Company almost since that time, working his way up to the management by his industry and ability to make friends. As an active and leading member of the National Metal Trades Association Mr. Moyer was well known to people in all parts of the United States and Canada. He also was identified prominently with the American Society of Mechanical Engineers.

Catalogues

The General Fire Extinguisher Co., Providence, R.I., have issued their July Number of the Grinnel Automatic Sprinkler Bulletin, which contains illustrations of buildings where Grinnel Sprinklers have been installed.

Boiler Scale

is easy to get rid of when you KNOW HOW. A mechanical Cleaner is the only *sure way*. You may use compounds of different make, but after using them for months you will find they have failed to remove the scale and have not prevented additional accumulation.

During this experimental trial your fuel bill has been gradually increasing, and when you come to count the cost, you have paid for wasted fuel the price of several LIBERTY CLEANERS, which would have thoroughly cleaned your boilers and restored their normal capacity. LIBERTY CLEANERS are the sure way to get rid of your scale trouble. They will take out all the scale and do it quickly and economically.

One man can operate any of our Cleaners, while it requires three or more men to run a power Cleaner. If you wish to economize in your operating expenses, throw away your compounds, power Cleaners and other types of cheaply made, inefficient Cleaners and put a LIBERTY on the job.

We furnish Cleaners for every type of boiler and to be operated by water, air or steam, to suit your conditions.

Write for descriptive catalog.

Liberty Manufacturing Company

6904 Susquehanna Street **PITTSBURGH, PA.**

Canadian Representatives:
Williams & Wilson, Ltd., Montreal. A. R. Williams Machinery Co., Toronto and Winnipeg.

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A six-hour catch of fish, leaves, etc., made by one basket of a Twin Strainer.

S uch
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R ubbish
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R iver or
S tream

to protect every plant that draws its water supply from lakes, ponds or rivers.

and the only convenient and efficient way to remove it from your water supply is with a Twin Strainer.

The TWIN STRAINER has two straining baskets and is made so that either one of the baskets may be cut out of the line at any time for cleaning, by simply shifting two valves.

If you are not acquainted with the Twin Strainer write for our catalog. It's ready for you.

ELLIOTT COMPANY

6902 Susquehanna Street, **PITTSBURGH, PA.**

CANADIAN REPRESENTATIVES:
Willams & Wilson, Ltd., Montreal. A. R. Williams Machinery Co., Ltd., Toronto and Winipeg.

The University of Illinois have issued bulletin No. 66 on "The Properties of Saturated and Superheated Ammonia Vapor." Copies may be had on application to the Engineering experiment station of the University at Urbana, Ill.

The International Engineering Works, Amherst, N.S., have issued a neat little leaflet illustrating the Robb vertical high speed and Corliss engines, the Robb-Scotch marine type, and water tube boilers, and the MacDonald shaking grates, etc.

Simplex Seatless Valves.—The Simplex Seatless Valve is described clearly in a pamphlet which we have received from the Garlock Packing Co., Hamilton . A copy of this pamphlet, which is entitled "The Solution of the Worst Boiler Room Problem," will be gladly mailed to interested readers.

"Wooster" Belting.—We have received a booklet describing the "Wooster" Belting, which is handled in Ontario by Wm. and J. G. Greey, Toronto. "Wooster" is a solid woven cotton, and not a "ply" or "sectional" belting. It is made in three standard thicknesses, and is made to withstand severe climatic conditions. The booklet will be gladly sent to interested readers .

Coates Clipper Mfg. Co., Worcester, Mass., have sent us a copy of their Bulletin No. 24, which illustrates and describes the different classes of work where "Flexishaft" can be used. The various equipments that can be used with "Flexishaft" are also illustrated, and show the wide range possessed by this flexible shafting. The reading matter and illustrations are clear and concise. Copies of the Bulletin will be mailed on request .

Blue Printing.—We have received from the C. F. Pease Co., Chicago, an interesting catalogue entitled "Everything for Blue Printing," which is a description of the "Peerless" blue printing machine. The complete process of making blue prints is embodied in the Peerless Machine, as it automatically prints, washes, and dries at one operation. The machine is fully described as is also all other equipment made by this firm. The catalogue is comprehensive, and a copy will be gladly sent on request.

The Main Drive is the title of a catalogue which the Federal Engineering Co., Toronto and Montreal, have issued recently. It deals mainly with "Scandinavia" and "Balata" belting, giving illustrations of these in actual use, and stating where they can be employed to the best advantage. A description of the method of manufacture is given, also some useful tables of horse power that may be transmitted. Other specialties handled by this company are also illustrated and described. Copies of this catalogue may be had by writing.

The Siemens Company, of Canada, Ltd., Montreal, have sent us a small pamphlet describing the Siemens Boiler Feed Water Meter. This apparatus is installed in the feed line, and registers exactly the amount of water being evaporated. It is, therefore, possible to tell if the boiler is being operated efficiently, and if the coal is of satisfactory quality. A comparison is made, showing how a systematic check can be had on the quality of coal used, by noting the evaporation. Copies will be gladly sent to interested readers.

The Link Belt Co., Philadelphia, have sent us a series of catalogues descriptive of the coal handling and transmission machinery which they manufacture. No. III. devoted to elevating and conveying machinery, coal washers, screens, etc.; No. 120 describes the "Peck Carrier" for colliery and factory purposes; while No. 124 describes the "Link Belt" chains and sprockets, and contains complete tables for use when ordering equipments. One catalogue is devoted to "Link Belt" locomotive cranes, and any of the above will be mailed on request.

Mechanical Stokers.—We have received from E. Bennis & Co., Ltd., Bolton, Eng., a copy of their latest pamphlet entitled "Cheap Steam and Machine Firing," which contains a description of the "Bennis" Stoker and other "Bennis" specialties. A concise description with illustrations is given of the construction and operation of their Standard Stoker. Illustrations are given of the stoker arranged for gas firing as an alternative to coal firing, also as adapted to leading types of boilers. Some interesting figures are given, taken from tests of the stokers with compressed air furnaces. The pamphlet has a very attractive cover, suggestive of the glowing fire and bright flame of the boiler room.

MONCRIEFF'S "UNIFIC" WATER GAUGE GLASSES

Stand in a Class by Themselves for Quality, Efficiency and Economy
A trial will convince you. Write for Catalog

W. J. WALL, 136-134 BLEURY ST., MONTREAL
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Federal Boiler Graphite

The one logical solution of your Scale troubles, at a daily cost of 2¼c per 100 h.p.

Here's the way "Federal" is sold

(Copy of our 60 Day Trial Order.)

Gentlemen:— Date .....

Please ship us

Bbl. (400 to 500 lbs.) .....@ 10c lb.
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of FEDERAL BOILER GRAPHITE, f.o.b. Cleveland or Milwaukee, subject to (60) Sixty Days' Trial.

If at the end of that period, same has proven satisfactory, it is to be paid for; if found unsatisfactory the remaining unused portion is to be returned to you AT YOUR EXPENSE, and no charge made us for that used in making the test.

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There's no strings attached to trying out "Federal." SIMPLY FILL OUT THE ORDER BLANK. THEN **TEAR OUT THIS ADVT. AND SEND IT TO US TO-DAY** and CONVINCE **YOURSELF** OF THE MERITS OF "FEDERAL" BOILER GRAPHITE.

We've an interesting Booklet and Table of Daily Costs that's free to all that desire more information on Boiler Graphite.

The Federal Graphite Mills
CLEVELAND **MILWAUKEE**

Classified Advertisements.

Those who wish to sell or buy a business, obtain competent help, connect with satisfactory positions or secure aid in starting new enterprises, should not fail to use the Want Ad. Page of The Power House.

Do you want to sell or buy a second hand engine or any other equipment? Let The Power House pick out a seller or buyer for you.

There is always some one looking for just such proposition as you have to offer.

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LIBERAL COMMISSIONS TO DEALERS AND others handling Vulcan Soot Cleaners; applied to all types of boilers. Vulcan Tube Cleaning Systems, Limited, 42 Craig St. West, Montreal. (4tf)

POSITION WANTED

ENGINEER—1ST CLASS, B.O.T. AND STATIONARY certs. 10 years' experience in steam, electric and heating plant; good machinist and fair draughtsman. Good references. Apply Box No. ..., The Power House, 143 University Ave., Toronto.

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WANTED—EVERY ENGINEER TO GIVE US a chance to figure on electrical repairing. Don't worry about how far away you are. From Halifax to Vancouver is our field. The Mead Electric Co., Unity Building, Montreal, Que.

WANTED — EVERY POWER HOUSE IN Canada to remember that C. E. Shedrick, Craig Street West, Montreal, is still repairing measuring instruments, both switchboard and portable. Twenty-five years' experience in repairing all kinds and makes on the market. Integrating meters repaired, tested and sealed, and returned on quick time.

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BELTING FOR SALE—800,000 FEET OF best quality leather, rubber, hair and canvas belting, bought from bankrupt manufacturers at 25% to 75% less than the regular value. Also a large quantity of slightly used belting, piping, chains, rails, pulleys, hangers, cotton waste, etc., at very low prices. Send for catalogue. Imperial Belting and Supply Co., 5 Queen Street, Montreal.

WANTED

WANTED—CANADIAN REPRESENTATIVE to distribute ice making and refrigerating machinery, internal combustion engines of all kinds, and special machinery of any kind built to order. Cleveland Ice Machine & Mfg. Co., Lorain, Ohio, U.S.A.

THE PROPRIETORS OF LETTERS PATENT No. 127080 relating to "Process of Manufacturing Iron Electrodes for use in Alkaline Accumulators" and No. 127081 relating to "Active Masses for Positive Electrodes of Electric Elements, etc." desire to dispose of the Patents or to grant Licenses to interested parties at reasonable terms with a view to the adequate working of the Patents in Canada. Inquiries to be addressed to the actual proprietors, Svenska Ackumulator Aktiebolaget Jungner, Stockholm, Sweden.

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GOOD STENOGRAPHERS ARE WHAT every employer wants. The place to get good stenographers is at the Remington Employment Department. No charge for the service. Remington Typewriter Co., Ltd., 144 Bay St., Toronto.

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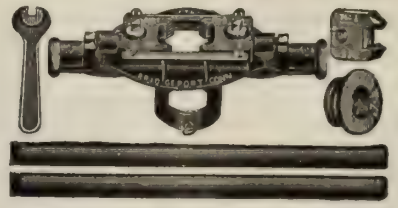

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Has been made and sold by the oldest and largest graphite concern in the world. Every pound of Dixon's Flake Boiler Graphite carries to its user the benefits of the Dixon experience of eighty-six years.

Let us send you the booklet. "Graphite For The Boiler", No. 222

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Ideas at 2 Cents Each

¶ An idea that's worth anything at all to a Power Plant man is worth more than two cents.

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¶ Every issue of "THE POWER HOUSE" is full of practical, helpful ideas. You ought to be able to sift out four each month that would prove of some use to you. Put a value of two cents on each and your subscription has been paid.

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Neglect blew up the Boiler

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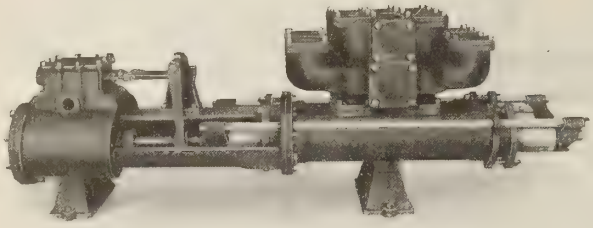

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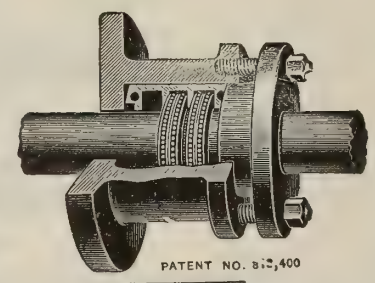

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Lasts many times longer. 30 days trial. Less oil. No cutting. Easily applied to any Steam Engine, Air Compressor or Gas Engine. Satisfaction or no pay. Write us.

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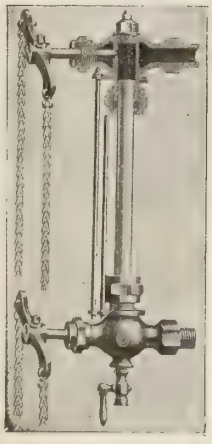

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Water Gauge

Comes to you fitted with high-grade steam packing—ready to use.

Chain operation protects user.

Ohio Water Gauges, Gauge Cocks and Regulating Valves can be obtained promptly from your dealer.

Write for Catalogue K.C.

The Ohio Brass Co., Mansfield, O.

Notice to Stationary Engineers

Everyone operating a Stationary Steam Plant of 50 h.p. or over, in the Province of Ontario, must hold a Certificate from this Board. Anyone operating such a plant without a Certificate is liable to the penalties set forth in the Stationary Engineers' Act

HON. J. S. DUFF,
Minister of Agriculture.

W. C. McGHIE,
Chairman of Board,
Parliament Buildings, Toronto

Mueller Pressure Reducing and Regulating Valves

Give accurate and absolute control of pressures of water, steam, air, gas, oil, carbonic and acetylene gases—in fact, all kinds of pressures. Their efficiency is firmly established. Manufactured under Canadian patent No. 127,566. Address:

H. Mueller Mfg. Company, Ltd.
Sarnia - Ontario

Don't Use Boiler Compounds

Which are always injurious to boilers and valves.

We guarantee an absolute Metal Clean Boiler, when there is sufficient exhaust steam. Get the Nobis habit around your power plant.

Best References

The Nobis Engineering Co.

GUSTAV NOBIS
Rheydt, Germany
ENGINEER, MANUFACTURER AND HEATING CONTRACTOR
Founded 1880

Heating Engineers and Contractors
329 King St. West, Toronto
Phone Adelaide 3669.

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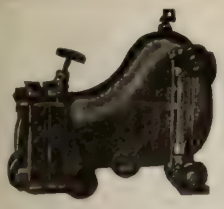


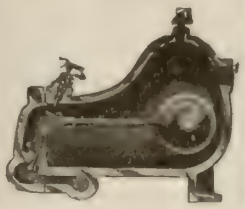
McDANIEL IMPROVED STEAM TRAP

FOR HIGH OR LOW PRESSURE.

Steam can't blow through. They have large discharge valves and cannot be flooded from sudden flushes of water.

MAY WE SEND ONE FOR TRIAL?

Reducing Valves, Pump Governors, Relief Valves, Exhaust Pipe Heads, Ejectors and Steam Separators. SEND FOR CATALOGUE.



THE GARTH COMPANY
26 Craig St. MONTREAL, CAN.
WATSON & McDANIEL CO.,
No. 146 N. 7th St. PHILADELPHIA, Pa.

LUBRICATING OILS

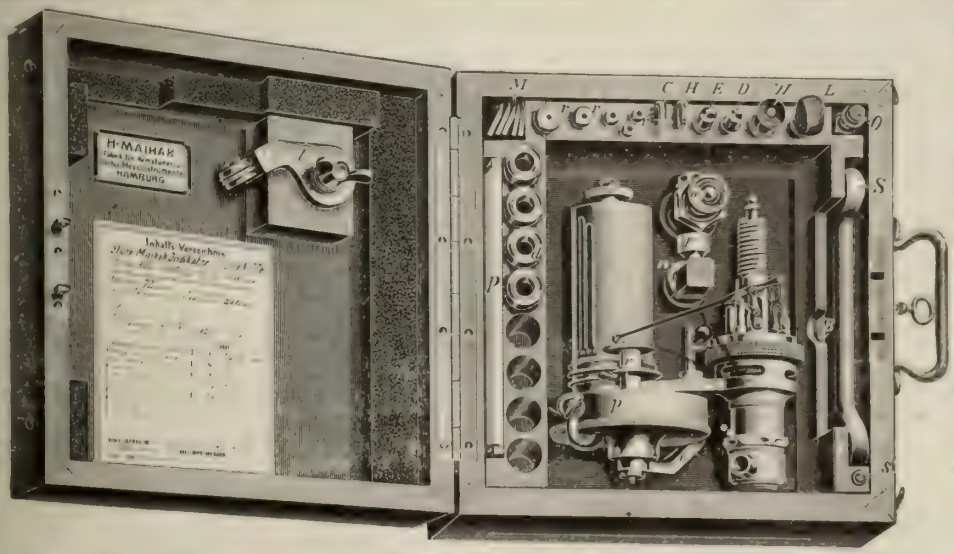
Canadian Oil Companies, Limited

TORONTO MONTREAL ST. JOHN
HALIFAX WINNIPEG
REGINA CALGARY
NELSON

In mechanical strength, wearing quality, fineness of texture and lubricating quality every Le Carbone Brush in a million is absolutely uniform.

This means that a type of Le Carbone Brush once installed to meet your conditions will always meet them on subsequent shipments. The quality of Le Carbone Brushes never varies.

Rougier Freres, Inc.
63 NOTRE DAME EAST, MONTREAL



Send to us for Catalogs

of the Maihak Indicator, Tachometers, Tachographs, Stroke Counters, Revolution Counters and

Detector Phone

This indicator made in Germany is the best in the world.

Outside spring, and easily exchanged.

Indicator Specialties; Locomotive Indicators with Electrical Attachment; Bottcher's Efficiency Reckoners; Spring Testing Plants.

What is Detector Phone?

Write for Description.

THE MAIHAK INDICATOR AGENCY, 3 Beaver Hall Square, Montreal

BEATH CRANES CHAIN BLOCKS TROLLEYS OVERHEAD RUNWAYS

Solve Coal, Machinery and Merchandise Handling Problems.

Hand, Pneumatic and Electrically Operated.

Tell us what you wish to do, and we'll suggest the proper equipment for you.

W. D. BEATH & SON, Limited
Engineers and Manufacturers
20-30 Cooper Ave. TORONTO

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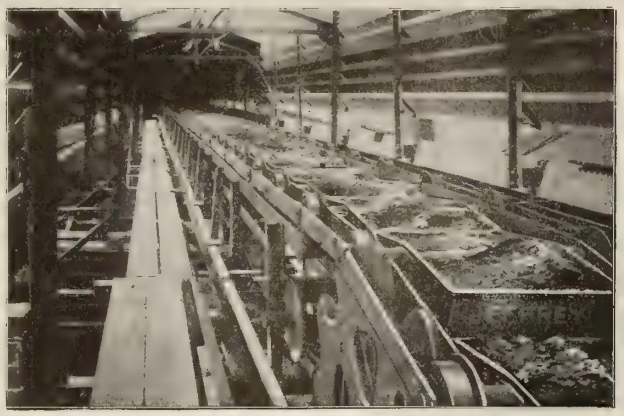


Upper Run of Jeffrey Contact-Lip Pivoted Bucket Conveyer handling 50 tons coal per hour.

Do You Believe in Practical-Scientific Management?

Jeffrey *Standard* Coal and Ashes Handling Machinery

is right from both an Engineering and Scientific-Management Standpoint, as proven by the many satisfactory equipments we have installed.

Catalog No. 32-A shows numerous installations, some of which may have a direct application to your own conditions. Write for copy.

JEFFREY MANUFACTURING COMPANY
Canadian Main Office and Works, MONTREAL
Winnipeg Representatives, N. J. DINNEN & CO.

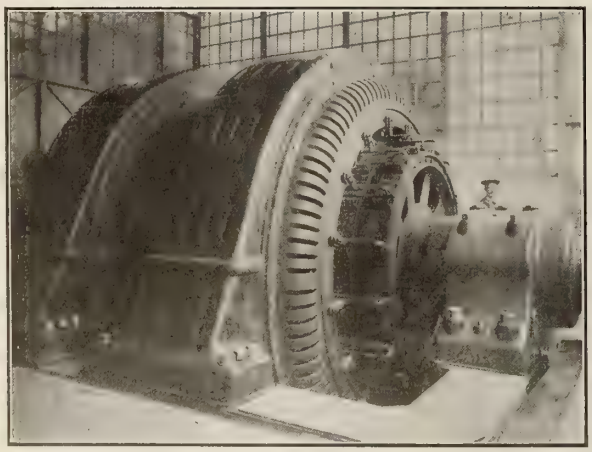
Second Hand BOILERS

We have a few exceptionally good Second-Hand Horizontal Tubular Boilers in stock which we are offering at very attractive prices.

Some of them are practically new and all of them are in good order, and if you want a second-hand boiler, this is a particularly good opportunity for you.

Shall we send you particulars?

William Hamilton Co.
PETERBOROUGH, ONT.



15,000 h.p. Motor, Driving a Reversible Rolling Mill 60 r.p.m. Reversing 15 times per minute.

POWER PLANTS, ROLLING MILLS, MINING, HOISTING MACHINERY

ELEVATORS, PATENT "STIGLER"

Builders under patents of STE. ALSACIENNE

Belfort (France) Mulhouse Grafenstaden (Germany)

Engineering Works of Canada
807 New Birks Building
MONTREAL, Quebec

WALKER'S ELECTRIC BOILER COMPOUND

Will eliminate all your boiler troubles and fuel losses due to impurities in the feed water.

It has been on the market for over 25 years, and does all that we claim for it without the slightest injury to tubes, packings or connections.

Give it a trial—if unsatisfactory it will cost you nothing.

We carry all kinds of high-grade **Lubricating Oils, Greases, Packings, and Engine Supplies.**

The Electric Boiler Compound COMPANY, LIMITED
Guelph, - - Ontario

The advertiser would like to know where you saw his advertisement—tell him.

GRAPHITOL

Pat. and Trade Mark Reg'd.

"Graphitol" is a graphite powder and liquid which, in combination, embody the cement principle applied to the production of a lubricated bearing material of hardness and durability.

No heating is required, and the mixture sets in a reasonable length of time.

Graphitol bearings require less lubricant, as the material is to a high degree self-lubricating, in addition to which it absorbs oil and feeds it evenly over the entire bearing surface without waste.

The heat resisting properties of graphite are well known.

Free illustrated pamphlet will be sent upon request to

British Pacific Supply Company

F. C. Winkler, Manager.

VICTORIA, B. C.

MAKERS OF GRAPHITOL.

COAL

The freight and duty is the same on **high grade coal** as on medium or low grade coal.

Our **Lone Star** small coal is **guaranteed** to show 14,000 B.T.U.'s regularly.

Our specialty in Canada is high grade coal from Kentucky and West Virginia via Detroit.

Let us have your inquiries, and call on us if in need of **prompt shipment,** via Buffalo, Car Ferry or Detroit.

Ohio & Michigan Coal Co.

Mines in Ohio, West Virginia and Kentucky

Main Office

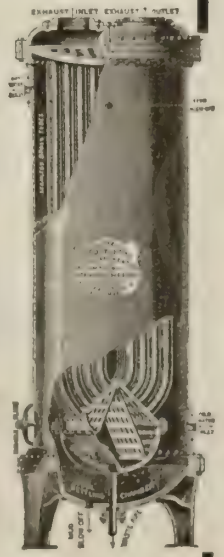
82-83-84 Home Bank Bldg., DETROIT, MICH.

Save Fuel and Increase Profit

A few engineers find this a difficult problem. They are not acquainted with

The "OTIS"

TUBULAR FEED WATER HEATER, OIL SEPARATOR AND PURIFIER

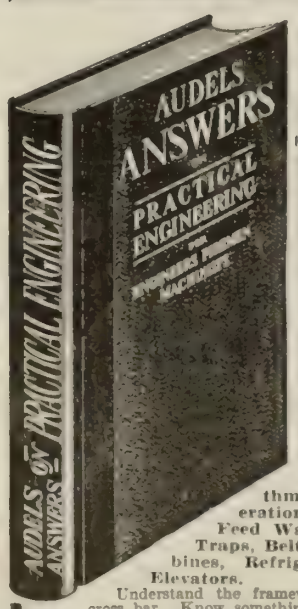


The exhaust steam when harnessed and passed through this Heater will heat the Feed Water to a boiling point before it enters the boiler. This effects an enormous yearly saving in fuel.

Write for descriptive catalog and prices.

The STEWART HEATER CO.

189 Norfolk Ave., Buffalo, N.Y., U.S.A.



When you spend your good hard earned money for books, always make sure that you are going to receive something that will assist you in bettering your position.

THIS book deals largely with the foundation principles which govern the practice of steam engineering. Nothing so soon condemns the applicant as want of knowledge of the every day practice and simple laws relating to the care and management of a steam plant.

No one is expected to know everything, but all are required to be familiar with certain facts which may be called "the beginning of things." The lack of knowledge of the small things carries conviction of the same lack in the larger.

Plain facts, that you should know, are plainly explained in AUDELS ANSWERS ON PRACTICAL ENGINEERING, answers your questions on

Air, Water, Steam, Fuel and Heat, Steam Boilers, Boiler Construction, Water Tube Boilers. The Steam Gauge, The Safety Valve, Properties of Steam, Installation of Boilers, Management of Boilers, Engineers' Law, Firemen's Law, Steam Engines, The Valve and Valve Gear, The Corliss Engine, Engine Arithmetic, Lubricators, Installation and Operation of Engines, Steam Pumps, Injectors, Feed Water Heaters, Steam Heating, Steam Traps, Belts, Gears and Pulleys, Steam Turbines, Refrigeration, Practical Electricity, Elevators.

Understand the framework of which your work is but a cross bar. Know something of the cause of which your work is but an effect. Know something of the effect of which your work is the cause. And, above all, know why it is done one way and not another.

EARN THE THEORY UNDERLYING THE WORK

PRACTICAL ENGINEERING contains 288 pages fully illustrated, handsomely bound and printed, and is in every way a first class book.

FREE EXAMINATION

Sign and mail the coupon, and it will bring to your plant a book of sterling merit, for free examination. You can have one week in which to dig out the mine of valuable information contained in its 200 or more pages.

THEO. AUDEL & CO., 72 5th Ave., NEW YORK

Please send me for examination one copy Audels Answers on Practical Engineering $1

If I keep the book, I promise to send you within 7 days after receiving it ONE DOLLAR in full payment; If I do not keep it, I will mail it back to you within 7 days.

Signature .....

Occupation .....

Address ..... Power House

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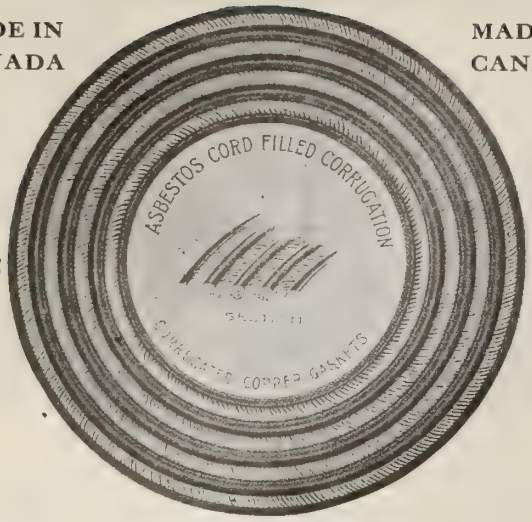
MADE IN CANADA



MADE IN CANADA

To The Engineers, Steamfitters and Users of Gaskets

Our revised discounts, place these gaskets for all purposes cheaper than anything else on the market.

DISCOUNTS, 40—10—5% off regular list

The cheapest for low pressure and the most serviceable for high pressure.

We carry a large stock of all sizes, and make prompt shipments.

Send your orders along.

CANADIAN GASKET COMPANY
BRIDGEBURG, ONT.
Manufacturers of all kinds of Metal Gaskets

Machine Banded Wood Stave

WATERPIPES and TANKS

For city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited

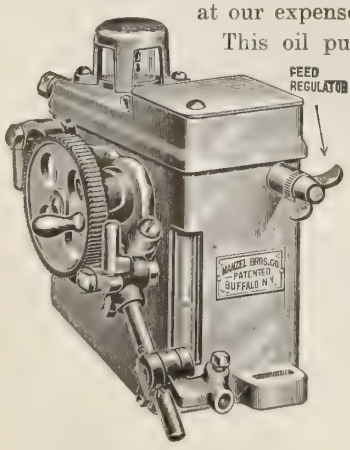
P.O. Box 563 **Vancouver, B.C**

WRITE FOR CATALOGUE

Full Particulars and Estimates Furnished

Try This Oil Saver At Our Expense

We will send the **Manzel Automatic and Sight Feed Oil Pump to you on a 30 days' trial.** If it does not **save 50 per cent of your oil** return it at our expense.



This oil pump gives positive lubrication and feeds regularly regardless of steam pressure, temperature, speed of engine, or any kind of oil used.

Write us To-day.

THE TWIN CITY OIL COMPANY
General Agents for Canada
BERLIN, - - ONTARIO
MANZEL BROTHERS COMPANY, BUFFALO, N.Y.

Detroit Lubricators for every engine

Detroit Lubricators are made in styles and sizes for every kind of steam engine, pump, gas and gasoline engine or other machines of any kind.

The big 232-page Detroit catalog shows sight feed lubricators mechanical force feed oilers, hand pumps, glass oil cups, brass oilers, grease cups, air cocks, priming cups, water gauges and other boiler trimmings, a complete line of radiator valves and a multitude of other devices.

It gives instructions for all lubricators, and contains valuable information on the general subject of lubrication.

Detroit products are standard the world over. The first lubricator ever sold was manufactured by the Detroit Lubricator Company, and the reputation acquired as originators has been maintained by meeting at once every requirement in the entire field of lubrication, and by producing devices unequalled for efficiency, economy, durability, workmanship and quality of material. Over 1,250,000 Detroit Lubricators are in use to-day.

Write to-day for catalog G-58 and full information.

CANADIAN DETROIT LUBRICATOR COMPANY, LTD.
WALKERVILLE, ONTARIO
Largest manufacturers of lubricating device in the world.

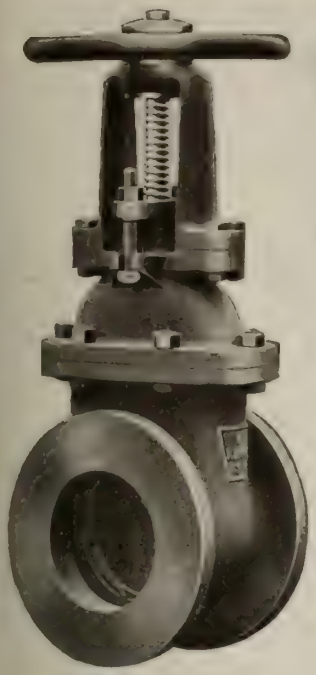
The advertiser would like to know where you saw his advertisement—tell him.

KERR GATE VALVES

OUTSIDE SCREW AND YOKE

"KEYSTONE" PATTERN

Embody all the latest features



4½-in. and larger

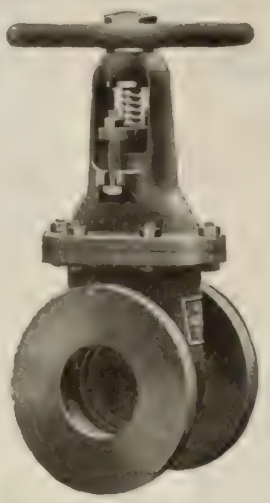
Screwed in Seats

Deep Bronze Bushed Gland and Stuffing Boxes.

Full Opening.

Large Diameter Hand-Wheels.

Solid Wedge Discs.



4-in. and smaller

Narrow face-to-face Dimensions

Symmetrical Design.

Good Material.

Interchangeable Parts.

Guaranteed Tested.

4½-in and larger

The Kerr Engine Co., Limited, MANUFACTURERS

Walkerville, Ontario

THE

CANADIAN CASUALTY

AND

BOILER INSURANCE COMPANY

This Company makes a specialty of inspecting boilers under construction, and issues an official Certificate of Inspection, as required by the Laws of Ontario which came into force on the 1st July.

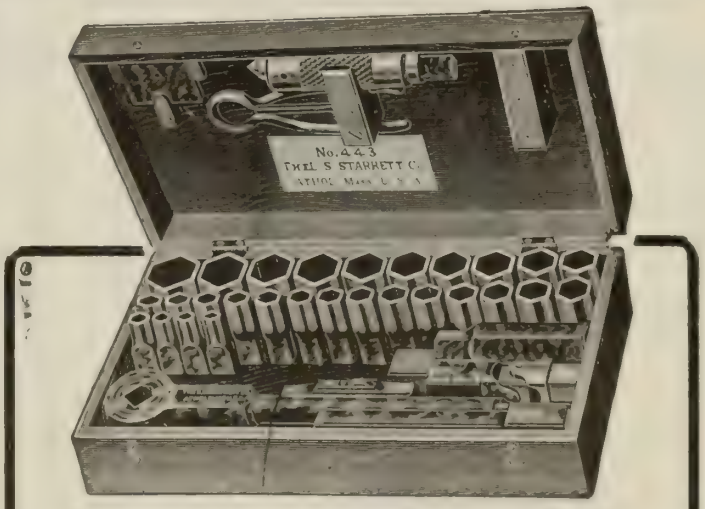
CONTINENTAL LIFE BUILDING

TORONTO

J. O. B. Latour, Chief Engineer.

John J. Durance, Manager.

Phone Main 6941



You're never cornered with a

Starrett Patent Ratchet Wrench

It will turn any standard nut or bolt in all sorts of difficult places—places where the ordinary monkey-wrench is useless. The ratchet permits rapid action with only a short arc swing. The extension reaches into otherwise inaccessible places. The drilling attachment furnished with the wrench takes any twist drill from ⅛ to ½ inch. A reversible screw-driver makes it handy for turning screws of various sizes, too.

Send for Catalog No. 19 CD

THE L. S. STARRETT CO., ATHOL, MASS.

42-59

The advertiser would like to know where you saw his advertisement—tell him.

"Maple Leaf" Brand

Stitched Cotton Duck Belting

THE BEST FOR ALL KINDS OF BELTS

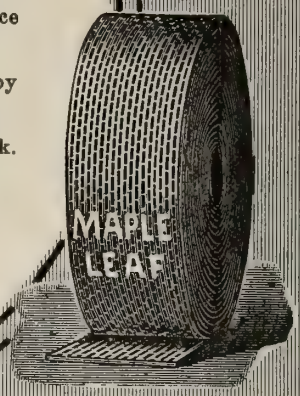
Means Reduced Upkeep Expense and Efficient Service

There is a "Maple Leaf" Belt for every service from the heaviest drive to the smallest light belt.

It is durable under dry or wet conditions, and is by far the most economical belting that you can use.

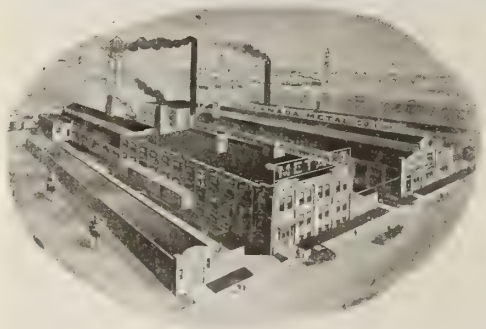
It is made by experts from plies of selected duck. Absolutely guaranteed.

Ask us for further information and prices.



Dominion Belting Co., Ltd.,

HAMILTON, CANADA



SEND ME A BOX OF BABBITT
THE KIND THAT DOES NOT WEAR OUT

WE RECEIVED A LETTER from a customer a few days ago, the following is an extract, "Send me a box of Babbitt, same as last, I forget the name, but it is the kind that does not wear out."

This is a Testimonial Indeed and one Straight from the Heart.

The writer of the letter above mentioned had evidently got a Babbitt Metal just suited to his specific purpose.

THAT IS WHERE WE EXCEL. We can advise you, it costs you nothing to take advantage of our years of practical experience. If you have Babbitt Troubles, why not ask our advice?

WE RECOMMEND

IMPERIAL GENUINE "The Highest Grade of Babbitt Metal manufactured" for all High Speed Engines and Bearings carrying extremely heavy loads.

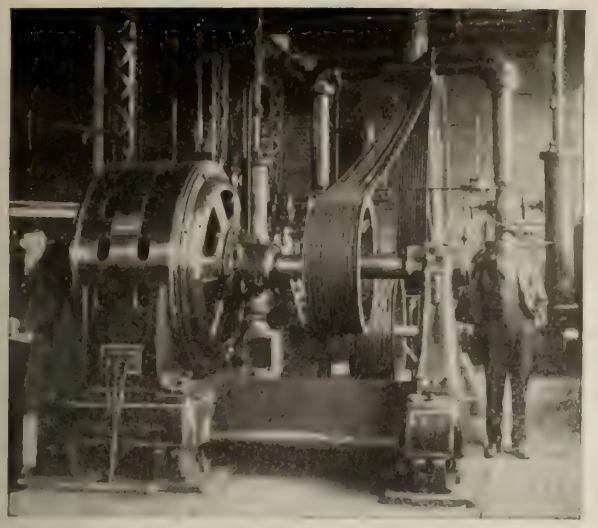
HARRIS HEAVY PRESSURE "The Babbitt Metal Without a Fault" for all General Machinery Bearings.

ALUMINOID For Medium and Light Running Machinery.

EVERY USER OF BABBITT METALS SHOULD GET OUR PRICES.

THE CANADA METAL CO., Limited

Head Office and Factory: TORONTO. Branch Factories: MONTREAL, WINNIPEG



Ten 1 1-8 inch 4-strand manila rope drive from a 200 h.p. motor, driving two 54 r.p.m. ammonia compressors, with 38 in. sheave on motor and 22 ft. sheave on compressors. Before using Cling-Surface about 400 pounds weight was carried on carriage and there was slip. Since using Cling-Surface this weight was reduced about 25 per cent., slipping stopped, and now ropes run easy.

Yes Sir: Cling-Surface is unequaled for rope treatment. Here is proof.

This shows one of the ropes in the plant of the Crystal Ice & Storage Co., Buffalo, N. Y., that have been typically benefited by Cling-Surface treatment. Ernest J. Lancey, Chief Engineer, has this to say:

"Cling-Surface has done these ropes much good by not only preventing slip with less tension, but by keeping them pliable, waterproof, and keeping all the fibres lubricated, which reduces the internal friction and outside wear. We recently installed a new rope, and intend to start right with Cling-Surface."

Cling-Surface is of as great value for ropes as it is for belts. It acts for ropes much as it does for a porous belt; gradually penetrates all through, keeping the whole rope pliable and in best physical condition. Cling-Surface makes each fibre slide smoothly against its neighbors, which is better than the dry internal grinding and chafing that occurs without Cling-Surface treatment, and is so destructive.

Cling-Surface also waterproofs (it will not wash out in the rain), and stops the slipping, just as it does for belts, making the drive carry full load with reduced tension. Cling-Surface treated ropes can run easy or slack and with much reduced weight on the tension carriage.

Cling-Surface treatment does not make belts or ropes sticky; it contains no rosin or acids; has been used for ropes for over 15 years and is used and recommended by many large rope manufacturers.

If you have a difficult drive on which other methods of preventing slip have failed and on which you would like to try Cling-Surface, let us know. Cling-Surface offers the solution and we are ready to prove this to you at our risk. Write to-day and get details and quotations. We quote f.o.b. Toronto.

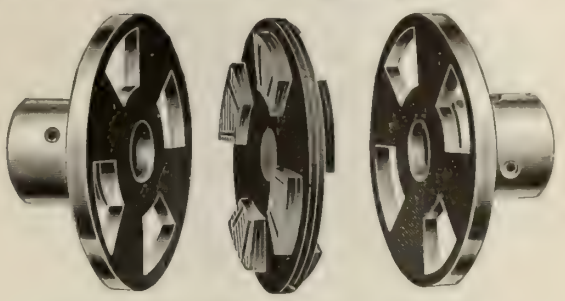
Cling-Surface Co

1057 Niagara Street
Buffalo N Y

67

BOND COUPLINGS

For Maximum Coupling Service



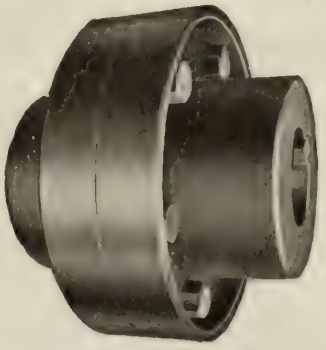
Grundy Flexible Insulated Coupling for direct drives.

Will outwear any other Flexible Coupling

The "Bond" Patent Spiro Compression Coupling.

50% more gripping force than any other Compression Coupling

Plate Coupling

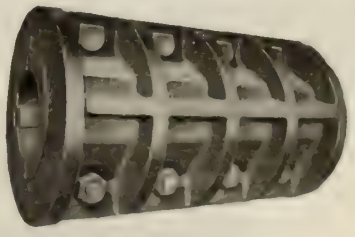


Bond Couplings have no superiors. They have been proven best by actual service test. If you are not using them let's get acquainted. We can save you money, time and trouble.

Clamp Compression Coupling

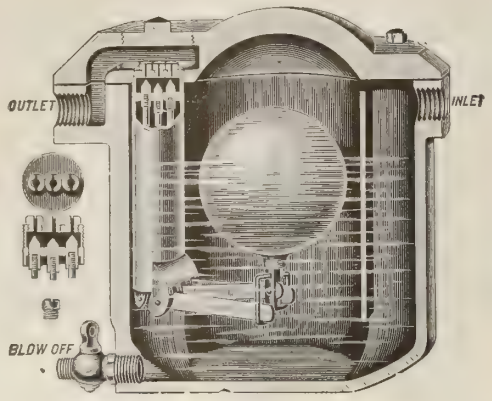
We have anything in transmission.

Ask for catalog No. 25—it will give you a comprehensive idea of Bond Quality.



Canadian Bond Hanger & Coupling Co., Ltd.

ALEXANDRIA, ONT.



Wright
"Emergency" High Pressure Continual Flow Steam Trap

THREE VALVES

GREAT CAPACITY

Keeps the steam line automatically and continually drained of accumulating condensation.

Shipped subject to trial and return if results are not satisfactory.

Send for Catalog.

DARLING BROS., Limited

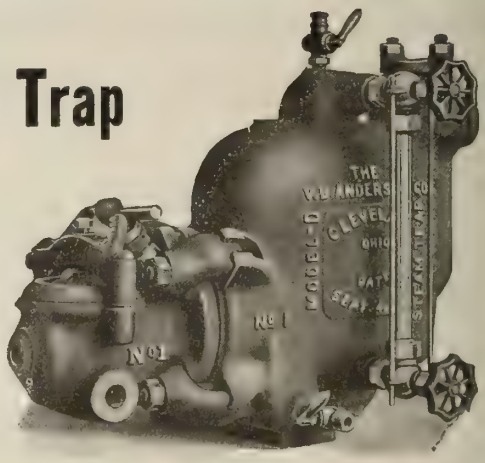
15 Ottawa Street, MONTREAL

TORONTO WINNIPEG ST. JOHN, N.B.

Every part of

The Anderson Model "D" Steam Trap

is Designed to give Efficient and Economical Service



This is the perfect steam trap because it automatically and continuously drains the condensation from radiators, steam coils or heating system without reducing pressure or permitting the escape of live steam.

Model "D" steam traps can be changed from high to low pressure or vice versa by simply ordering the necessary valves and seats for pressure desired.

Removable perforated strainer which is part of the equipment, prevents pieces of scale, lead, etc., from entering traps.

All parts are interchangeable.

The cut below shows the complete working mechanism of a model "D" trap, consisting of Hanger, Float Lever, Counter Weight and Valve Connection assembled together to fit into its place on the head. These assembled parts are very accurately built, and fitted up with just the right amount of play to allow for expansion and insure free working.

Our booklet contains full description—drop a card for it **TO-DAY.**

THE V. D. ANDERSON Company

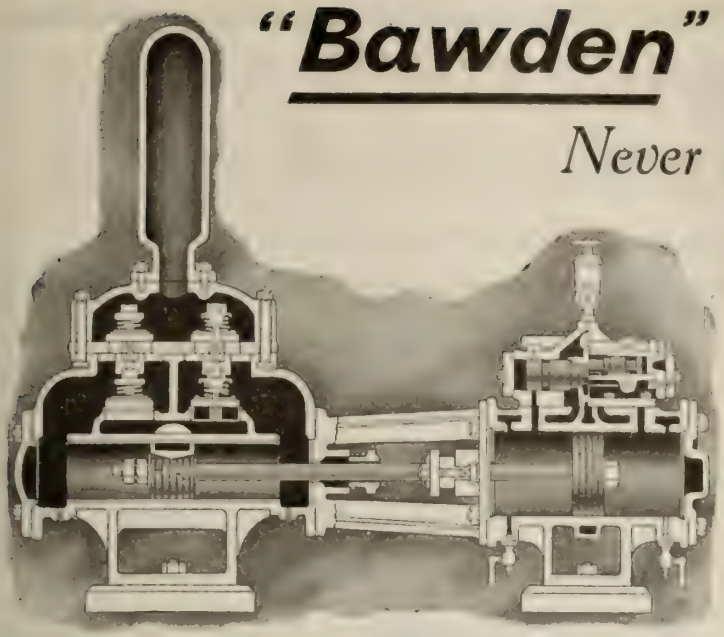
1935 West 95th St., CLEVELAND, OHIO

BRANCH OFFICES: 330 Manhattan Building, Chicago, Ill.; 619 Park Bldg., Pittsburg, Pa.; 3 Arch St., Philadelphia, Pa.; 212 Walnut St., Cincinnati, Ohio; 207 Union Trust Building, Baltimore, Md.; 91 High Street, Boston, Mass.

The advertiser would like to know where you saw his advertisement—tell him.

"Bawden" Steam Pumps

Never Need Adjusting



Will Go As Long As Steam Is Turned On.

Simple and Compound

No Tappets
No External Valve Gear
No Internal Tubes
No Internal Stuffing Glands

¶ "Bawden" Pumps are governed by piston valves which are controlled by the action of live steam only.
Simplicity throughout.
Greatest economy of steam consumption.
Valves, latest improved steam balanced type.
Guaranteed to make full stroke under constant or varying loads.

¶ The "Bawden" Pump provides the simplest, most economical and reliable means for feeding high or low pressure boilers.
Flexibility of speed obtained without any mechanical adjustment.
Automatic cushioning of piston and valves ensures greatest safety in any emergency.

SEND FOR CIRCULAR AND PRICES.

QUEBEC AGENTS: H. L. PEILER & CO., 380 St. James Street, MONTREAL

The Bawden Machine Co., Limited TORONTO CANADA

Marsh Steam Pump

The Pump with the Self-governing Steam Valve

Note the extreme simplicity in construction and the absence of outside valve motion. There is practically nothing to get out of order. Nearly all the wearing parts are made of phosphor bronze instead of common brass, including piston rod, water cylinder lining and valve seats.

The steam valve is self-governing and admits only just enough steam to do the required work. The pump cannot short-stroke, race or pound under the most severe conditions.

115,000 in successful operation.

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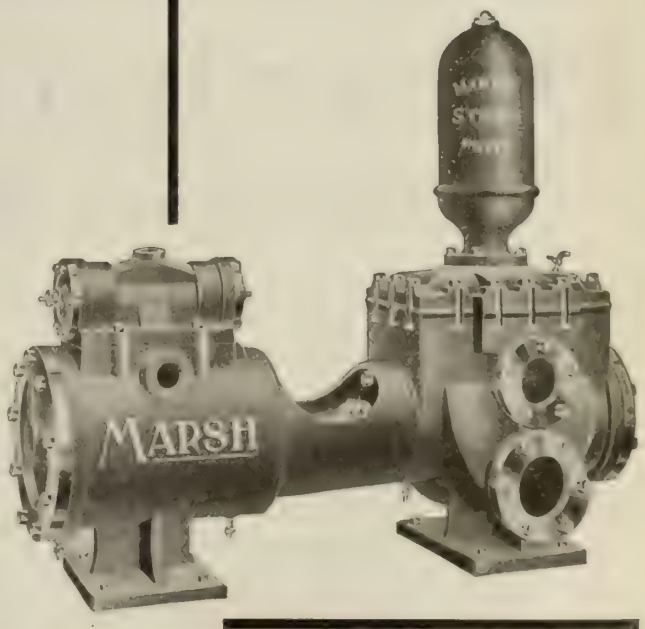

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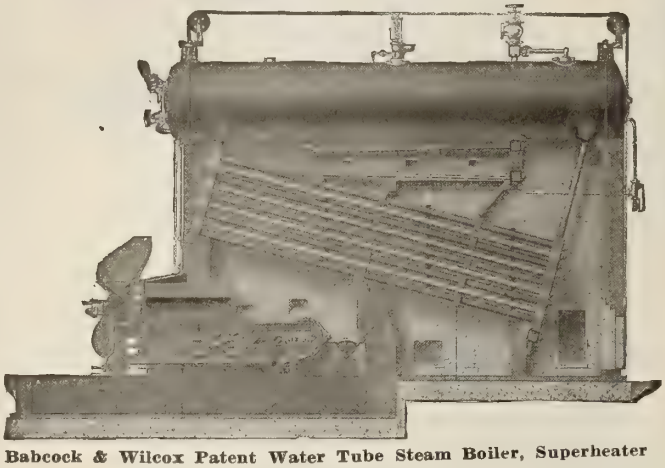

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Waterous Engine Works Co., Brantford.
Can. Allis-Chalmers, Ltd., Toronto.

Molds, Rubber.
Bawden Machine Co., Toronto.

Motors.
Can. Fairbanks-Morse Co., Montreal.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.
Northern Electric & Mfg. Co., Limited, Montreal.
Siemens Co. of Canada, Ltd. Montreal.

Motor Starters and Controllers.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.
Siemens Co. of Canada, Ltd. Montreal.

Office Railings.
Jas. Morrison Brass Mfg. Co., Toronto.

Oil Cups.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.

Oiler Compound Feeders.
Lunkenheimer Co., Cincinnati, O.

Oilers, Gauge.
Lunkenheimer Co., Cincinnati, O.

Oilers, Multiple.
Can. Detroit Lubricator Co., Windsor,
Lunkenheimer Co., Cincinnati, O.

Oil Filters & Circulating Systems.
S. F. Bowser & Co., Inc., Toronto.
Darling Bros., Montreal.
Elliott Co., Pittsburgh, Pa.
Jas. Morrison Brass Mfg. Co., Toronto.
The Sims Co., Erie, Pa.

Oil Separators, Ammonia.
Steam Appliance Co., Milwaukee,

Oil Separators.
Babcock & Wilcox, Montreal.
Can. Fairbanks-Morse Co., Montreal.
Can. Allis-Chalmers, Ltd., Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
C. A. Dunham Co., Toronto.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
Liberty Mfg. Co., Pittsburg.
Jas. Morrison Brass Mfg. Co., Toronto.
Smart - Turner Machine Co., Ltd., Hamilton.
Steam Appliance Co., Milwaukee

Oiling Systems.
S. F. Bowser & Co., Inc., Toronto.

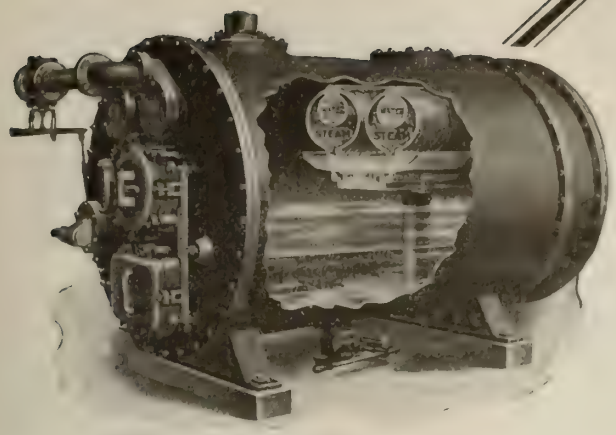
Oils, Lubricating.
British Pacific Supply Co., Victoria.
Can. Oil Companies, Ltd., Toronto.
Dearborn Chemical Co., Chicago.
C. C. Snowdon, Calgary.

Packing Engine.
Can. H. W. Johns-Manville Co., Toronto.
Dunlop Tire & Rubber Goods Co., Toronto.
Garlock Packing Co., Hamilton, Ont.
Steel Mill Packing Co., Windsor, Ont.

Packing, Metallic.
Holmes Metallic Packing Co., Wilkesbarre, Pa.
Quaker City Rubber Co., Philadelphia, Pa.
Steel Mill Packing Co., Windsor, Ont.

Packing, Rod.
Goetze-Gasket & Packing Co., New Brunswick, N.J.
Canadian H. W. Johns-Manville Co. Ltd., Toronto.
Garlock Packing Co., Hamilton, Can.
Steel Mill Packing Co., Windsor, Ont

Packing, Sheet.
Garlock Packing Co., Hamilton, Can.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.
Jenkins Bros., Ltd., Montreal.
Quaker City Rubber Co., Philadelphia, Pa.



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It's different because it has contact pipes extending the entire length. The water overflows the inner pipe and passes as a thin film over the outside. The steam leaving the port at the bottom of the large pipe passes through the curtain of water. The water is in direct contact with the steam.

NATIONAL Direct Contact Feed Water Heater

There is no scale, for the scale-forming substances don't reach the boiler—they're left behind in the heater.

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The "National" has upward filtration and many other features explained in our catalogue No. 2.

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¶ And getting better results is going to increase the size of your weekly envelope.

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Garlock Packing Co., Hamilton, Can.
Nobis Engineering Co., Toronto.
Quaker City Rubber Co., Philadelphia, Pa.
Steel Mill Packing Co., Windsor, Ont.

Packing, Leather.
Graton & Knight Mfg. Co., Worcester, Mass.

Patents.
Rowland Brittain, Vancouver, B.C.

Penstocks.
Can. Allis-Chalmers, Ltd., Toronto.
Boving & Co., of Canada, Limited, Toronto.

Penstock Lugs.
Otterville Mfg. Co., Otterville, Ont.

Pillow Blocks.
Can. Bond Hanger & Coupling Co., Alexandria.
Elmira Machinery & Transmission Co., Elmira, Ont.

Pipe Bending.
Nobis Engineering Co., Toronto.

Pipe Coils.
National Pipe Bending Co., New Haven, Conn.
York Mfg. Co., York, Pa.

Pipe Cutting and Treading Machine and Tools.
Can. Fairbanks-Morse Co., Montreal.

Pipe, Steel.
Can. Allis-Chalmers, Ltd., Toronto.
Boving & Co., of Canada, Limited, Toronto.
E. Leonard & Sons, London, Ont.

Pipe (Second-Hand).
Imperial Waste & Metal Co., Montreal.

Pipes, Water.
Can. Allis-Chalmers, Ltd., Toronto.
Boving & Co., of Canada, Limited, Toronto.
Pacific Coast Pipe Co., Vancouver, B. C.

Piping and Fittings.
Frick Co., Waynesboro, Franklin Co., Pa.
Jas. Morrison Brass Mfg. Co., Toronto.
York Mfg. Co., York, Pa.

Piping, Steam.
Babcock & Wilcox, Montreal.
Imperial Waste & Metal Co., Montreal.

Plate Work.
Can. Allis-Chalmers, Ltd., Toronto.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

Polish, Metal.
G. W. Hoffman, Indianapolis.

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American Steam Pump Co., Battle Creek, Mich.
Boving & Co., of Canada, Limited, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Can. Allis-Chalmers, Ltd., Toronto.
Darling Bros., Montreal.
Goldie & McCulloch Co., Galt.
Goulds Pump Co., Montreal.
E. Leonard & Sons, London, Ont.
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Smart - Turner Machine Co., Ltd., Hamilton.
Waterous Engine Works Co., Brantford.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.
Garlock Packing Co., Hamilton, Can.

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Can. Fairbanks-Morse Co., Montreal.
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Engineering Works of Canada, Ltd., Montreal.
Goldie & McCulloch Co., Galt.
Jeffrey Manufacturing Co., Columbus.
Jenckes Machine Co., Sherbrooke, Que.
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Waterous Engine Works Co., Brantford.
Siemens Co. of Canada, Ltd, Montreal.
American Pulley Co., Philadelphia.

Pulleys.
Can. Fairbanks-Morse Co., Montreal.
Elmira Machinery and Transmission Co., Elmira, Ont.
Jeffrey Manufacturing Co., Columbus.
Waterous Engine Works Co., Brantford.
American Pulley Co., Philadelphia.

Pulp Mill Machinery.
The Bawden Machine Co., Toronto.
Escher, Wyss & Co., Toronto.
Jeffrey Manufacturing Co., Columbus.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford.

Pumping Machinery.
American Steam Pump Co., Battle Creek, Mich.
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Can. Allis-Chalmers, Ltd., Toronto.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.
Standard Eng. Co., Toronto.
Waterous Engine Works Co., Brantford.

Pumping Machinery, Electrical.
Jeffrey Manufacturing Co., Columbus.

Pump Governors and Regulators.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
C. A. Dunham Co., Toronto.
G. M. Davis Regulator Co., Chicago, Ill.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
Smart - Turner Machine Co., Ltd., Hamilton.
Watson & McDaniel Co., Philadelphia.

Pump Strainers.
Canadian Steam Boiler Equipment Co., Toronto.
Liberty Mfg. Co., Pittsburgh, Pa.

Pumps, Air.
American Steam Pump Co., Battle Creek, Mich.
Boving & Co., of Canada, Limited, Toronto.
Can. Allis-Chalmers, Ltd., Toronto.
Can. Fairbanks-Morse Co., Montreal.
E. Leonard & Sons, London, Ont.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.

Pumps, Contractors'.
William Hamilton Co., Ltd., Peterborough.

Pumps, Hand and Power.
S. F. Bowser & Co., Inc., Toronto.

Pumps, Centrifugal.
Boving & Co., of Canada, Limited, Toronto.
Can. Allis-Chalmers, Ltd., Toronto.
Engineering Works of Canada, Ltd., Montreal.
Canadian Boving Co., Toronto.
Escher, Wyss & Co., Toronto.
Hare Eng. Co., Toronto.
E. Leonard & Sons, London, Ont.
John McDougall Caledonian Iron Wks. Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.
Waterous Engine Works Co., Brantford.

Pumps, Geared, Compound.
American Steam Pump Co., Battle Creek, Mich.
The Bawden Machine Co., Toronto.
Can. Allis-Chalmers, Ltd., Toronto.
Can. Fairbanks-Morse Co., Montreal.
E. Leonard & Sons, London, Ont.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.

Pumps, Hydraulic, Pressure.
American Steam Pump Co., Battle Creek, Mich.
Can. Allis-Chalmers, Ltd., Toronto.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.

Pump Leathers.
Graton & Knight Mfg. Co., Worcester, Mass.

Pumps, Oil.
The Bawden Machine Co., Toronto.
S. F. Bowser & Co., Inc., Toronto.
Can. Detroit Lubricator Co., Walkerville, Ont.
Lunkenheimer Co., Cincinnati, O.
Manzel Bros. Co., Buffalo, N.Y.
Smart - Turner Machine Co., Ltd., Hamilton.

Pumps, Steam.
American Steam Pump Co., Battle Creek, Mich.
Bawden Machine Co., Toronto.
S. F. Bowser & Co., Inc., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Can. Allis-Chalmers, Ltd., Toronto.
Darling Bros., Montreal.
C. A. Dunham Co., Toronto.
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.

Pumps, Triplex.
William Hamilton Co., Ltd., Peterborough.

Pumps, Vacuum.
American Steam Pump Co., Battle Creek, Mich.
The Bawden Machine Co., Toronto.
Boving & Co., of Canada, Limited, Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Hare Eng. Co., Toronto.
C. A. Dunham Co., Toronto.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.

Pump Tank, Receiver.
American Steam Pump Co., Battle Creek, Mich.
Can. Allis-Chalmers, Ltd., Toronto.

Pyrometers.
Jas. Morrison Brass Mfg. Co., Toronto.

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Imperial Waste & Metal Co., Montreal

Radiator Air Vents.
Jas. Morrison Brass Mfg. Co., Toronto.

Reboilers.
Frick Co., Waynesboro, Franklin Co., Pa.

Reels.
American Pulley Co., Philadelphia.

Refrigerator Doors, Windows, Etc.
Jones Cold Store Door Co., Hagerstown, Ind.

Refrigerating Engineers.
Arctic Ice Machine Co., Canton, Ohio.
Chas. Bishop, Montreal.

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Arctic Ice Machine Co. Canton, Ohio.
Frick Co., Waynesboro, Franklin Co., Pa.
Linde British Refrigeration Co., Montreal.
Linde Can. Refrigeration Co., Montreal.
Vilter Mfg. Co., Milwaukee, Wis.
York Mfg. Co., York, Pa.

Regulators, Pressure.
C. A. Dunham Co., Toronto.
Jas. Morrison Brass Mfg. Co., Toronto.
Ohio Brass Co., Mansfield, Ohio.
The Sims Co., Erie, Pa.

Revolving Doors for Hardening Rooms.
Jones Cold Store Door Co., Hagerstown, Md.

Revolution Counters.
Maihak Indicator Agency, Montreal.

Rheostats.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co. Hamilton.
Siemens Co. of Canada, Ltd. Montreal.

Roofings—Asbestos and Wool Felts
Canadian H. W. Johns-Manville Co., Ltd., Toronto.

Rope Preservative.
Cling Surface Co., Buffalo.

Rotary Converters.
Can. Fairbanks-Morse Co., Montreal.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Siemens Co. of Canada, Ltd. Montreal.

Rubber Hose.
Garlock Packing Co., Hamilton, Ont.
Liberty Mfg. Co., Pittsburg, Pa.
Quaker City Rubber Co., Philadelphia.

Rubber Molds.
The Bawden Machine Co., Toronto.

Safes.
Can. Fairbanks-Morse Co., Montreal.
Goldie & McCulloch Co., Galt.

Safety Valves.
Can. Fairbanks-Morse Co., Montreal.
Lunkenheimer Co., Cincinnati, O.

Sash Pulleys.
American Pulley Co., Philadelphia.

Separators, Oil, Steam and Ammonia.
Frick Co., Waynesboro, Franklin Co., Pa.

Shafting.
Elmira Machinery and Transmission Co., Elmira.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Wks. Co., Brantford

Shaking and Dumping Grates.
Babcock & Wilcox, Montreal.
Can. Steam Boiler Equipment Co., Toronto.
Hare Eng. Co., Toronto.
Waterous Engine Wks. Co., Brantford

Smoke Consumers.
Canadian Steam Boiler Equipment Co., Toronto.

Smoke Boxes, Stacks.
Babcock & Wilcox, Montreal.
Can. Allis-Chalmers, Ltd., Toronto.
E. Leonard & Sons, London, Ont.
Waterous Engine Wks. Co., Brantford

Smokeless Furnaces.
Jones Underfeed Stoker Co., Toronto.
Murphy Iron Wks., Detroit, Mich.
Geo. H. Tod, Manning Chambers, Toronto.

Soot Cleaners.
Vulcan Tube Cleaning Systems, Ltd., Montreal.

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Can. Fairbanks-Morse Co., Montreal.
Waterous Engine Wks. Co., Brantford

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Waterous Engine Wks. Co., Brantford

Spur Wheels.
Can. Fairbanks-Morse Co., Montreal.
Waterous Engine Wks. Co., Brantford

Stand Pipes, Steel.
Can. Allis-Chalmers, Ltd., Toronto.
William Hamilton Co., Ltd., Peterborough.

Steam Separators.
Can. Fairbanks-Morse Co., Montreal.
Can. Allis-Chalmers, Ltd., Toronto.
Darling Bros., Montreal.
C. A. Dunham Co., Toronto.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
The Sims Co., Erie, Pa.
Smart - Turner Machine Co., Ltd., Hamilton.
Steam Appliance Co., Milwaukee.

Watson & McDaniel Co. Philadelphia
Montreal.
Arctic Ice Machine Co., Canton, Ohio.

Steam Specialties.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Can. Allis-Chalmers, Ltd., Toronto.
Darling Bros., Montreal.
C. A. Dunham Co., Toronto.
Hare Eng. Co., Toronto.
Liberty Mfg. Co., Pittsburg, Pa.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co. Toronto.
Ohio Brass Co., Mansfield, O.
Penberthy Injector Co., Windsor.
The Sims Co., Erie, Pa.
Steam Appliance Co., Milwaukee.
Watson & McDaniel Co. Philadelphia
Vulcan Tube Cleaning System, Ltd., Montreal.

Steam Traps.
V. D. Anderson Co., Cleveland, O.
Can. Fairbanks-Morse Co., Montreal.
Can. Allis-Chalmers, Ltd., Toronto.
Darling Bros., Montreal.
G. M. Davis Regulator Co., Chicago.
C. A. Dunham Co., Toronto.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
Can .Morehead Mfg. Co., Woodstock,
Nobis Engineering Co., Toronto.
Schneider & Helmecke, Madgeburg, Germany.
Steam Appliance Co., Milwaukee, W.
Watson & McDaniel Co., Philadelphia

Steam Turbine Blowers.
Hare Eng. Co., Toronto.
International Engineering Works, Ltd., Amherst, N. S.

Steam Turbine Generators.
W. H. Allen Son & Co. Bedford, Eng.
Hare Eng. Co., Toronto.
International Engineering Works, Ltd., Amherst, N. S.
Siemens Co. of Canada, Ltd. Montreal.

Steam Turbine Pumps.
Hare Eng. Co., Toronto.

Steel Tanks.
William Hamilton Co., Ltd., Peterborough.

Stokers.
Hare Engraving Co., Ltd., Toronto.
Jones Underfeed Stoker Co., Toronto.
Murphy Iron Wks., Detroit, Mich.
Geo. H. Tod, Manning Chambers, Toronto.

Strainers.
Elliott Co., Pittsburg, Pa.

Superheaters, Steam.
Babcock & Wilcox, Montreal.

Switchboards, Light and Power.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.
Monarch Electric Co., St. Lambert, Que.
Siemens Co. of Canada, Ltd. Montreal.

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Canadian General Electric Co., Limited, Toronto.
Canadian Westinghouse Co., Hamilton.
Monarch Electric Co., St. Lambert, Que.
Siemens Co. of Canada, Ltd. Montreal.

Tachographs.
Maihak Indicator Agency, Montreal.

Tachometers.
Maihak Indicator Agency, Montreal.

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Darling Bros., Montreal.
John McDougall Caledonian Iron Wks. Montreal.

Tanks, Freezing, Storage and Water Cooling.
Frick Co., Waynesboro, Franklin Co., Pa.

Tanks, Oil.
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Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Wks. Co., Brantford

Tanks, Water.
Can. Allis-Chalmers, Ltd., Toronto.
Pac. Coast Pipe Co., Vancouver, B.C.

Telephones.
Northern Electric & Mfg. Co., Limited, Montreal.

Transformers.
Can. Fairbanks-Morse Co., Montreal.
Canadian General Electric Co., Ltd., Toronto.
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Can. Fairbanks-Morse Co., Montreal.
Elmira Machinery & Transmission Co., Elmira, Ont.
Goldie & McCulloch Co., Galt, Ont.
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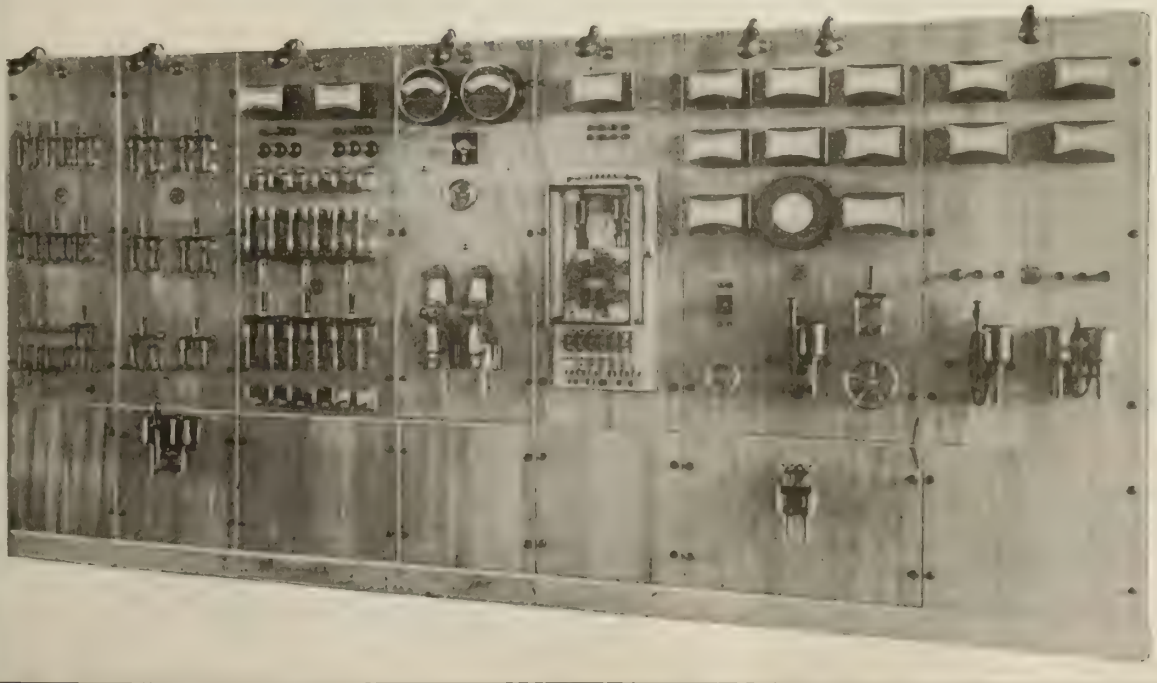

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Tube Cutters.
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Tubes, Boilers.
Babcock & Wilcox, Montreal.

Tube Expanders.
Liberty Mfg. Co., Pittsburg, Pa.

Tungsten Lamps.
Can. Sunbeam Lamp Co., Toronto.
Can. Tungsten Lamp Co., Hamilton, Ont.
Canadian General Electric Co., Ltd., Toronto.
G. Lewis, Montreal.

Turbine Water Wheels.
Canadian Boving Co., Hamilton.
Chas. Barber & Sons, Meaford, Ont.
Engineering Works of Canada, Ltd., Montreal.
Escher, Wyss & Co., Toronto.
Jenckes Machine Co., Sherbrooke, Que.
William Hamilton Co., Ltd., Peterborough.

Turbines, Steam.
Can. Allis-Chalmers, Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.
Escher, Wyss & Co., Toronto.
Hare Eng. Co., Toronto.
International Engineering Works, Ltd., Amherst, N.S.
Laurie & Lamb, Montreal.
John McDougall Caledonian Iron Wks. Montreal.

Unions.
Can. Fairbanks-Morse Co., Montreal.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.

Vacuum Governors.
Canadian Steam Boiler Equipment Co., Toronto.
G. M. Davis Regulator Co., Chicago.
Smart - Turner Machine Co., Ltd., Hamilton.

Vacuum Regulating Valves.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.

Vacuum Traps.
C. A. Dunham Co., Toronto.
Can. Morehead Mfg. Co., Woodstock, Ont.

Valve, Disk.
Goetze-Gasket & Packing Co., New Brunswick, N.J.

Valve, Reseating Machines.
Darling Bros., Montreal.

Valves.
Can. Allis-Chalmers, Ltd., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Canadian Steam Boiler Equipment Co., Toronto.
Frick Co., Waynesboro, Franklin Co., Pa.
G. M. Davis Regulator Co., Chicago.
Hare Eng. Co., Toronto.
Homestead Value Mfg. Co. Pittsburg.
Jenkins Bros., Montreal.
Kerr Engine Co., Walkerville, Ont.
Liberty Mfg. Co., Pittsburg, Pa.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
Nobis Engineering Co., Toronto.
Ohio Brass Co., Mansfield, Ohio.
Watson & McDaniel Co. Philadelphia

Valves, Blow-off.
Can. Fairbanks-Morse Co., Montreal.
Elliott Co., Pittsburgh, Pa.
Engineering Specialties Co., Toronto.
Jenkins Bros., Ltd., Montreal.
Lunkenheimer Co., Cincinnati, O.
Watson & McDaniel Co. Philadelphia

Valves, Gates.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
Ohio Brass Co., Mansfield, Ohio.

Valves, Reducing.
Liberty Mfg. Co., Pittsburg, Pa.
Jas. Morrison Brass Mfg. Co., Toronto.
Ohio Brass Co., Mansfield, Ohio.
Watson & McDaniel Co. Philadelphia
H. Mueller Mfg. Co., Ltd., Sarnia, Ont.

Valves, Radiator.
Jenkins Bros., Ltd., Montreal.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
Ohio Brass Co., Mansfield, Ohio.

Valves, Throttle.
Can. Detroit Lubricator Co., Walkerville, Ont.
Lunkenheimer Co., Cincinnati, O.

Vaults & Vault Doors.
Can. Fairbanks-Morse Co., Montreal.
Goldie & McCulloch Co., Galt.

Ventilating.
Nobis Engineering Co., Toronto.

Voltmeters.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Siemens Co. of Canada, Ltd. Montreal.

Washers, Leather.
Graton & Knight Mfg. Co., Worcester, Mass.

Waste and Wipes.
Imperial Waste & Metal Co., Montreal.

Water Columns, Gauges.
Elliott Co., Pittsburgh, Pa.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
W. J. Wall, Montreal.

Water Hose.
Liberty Mfg. Co., Pittsburgh, Pa.

Water Level Regulators.
Hare Eng. Co., Toronto.
Steam Appliance Co., Milwaukee,

Water Lifters.
Watson & McDaniel Co. Philadelphia

Water Motors.
Elliott Co., Pittsburgh, Pa.

Water Purifiers, Softeners.
Babcock & Wilcox, Montreal.
Nolis Engineering Co., Toronto.

Water Wheels.
Chas. Barber & Sons, Meaford, Ont.
John McDougall Caledonian Iron Wks. Montreal.
William Hamilton Co., Ltd., Peterborough.

Whistles, Plain or Chime.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.

Wire, Bare and Insulated.
Canadian General Electric Co., Ltd., Toronto.
Eugene F. Phillips Electrical Works, Ltd., Montreal.

Wire, Magnet and Trolley.
Canadian General Electric Co., Ltd., Toronto.
Eugene F. Phillips Electrical Works, Ltd., Montreal.

Wire, Railway Feeder and Trolley.
Canadian General Electric Co., Ltd., Toronto.
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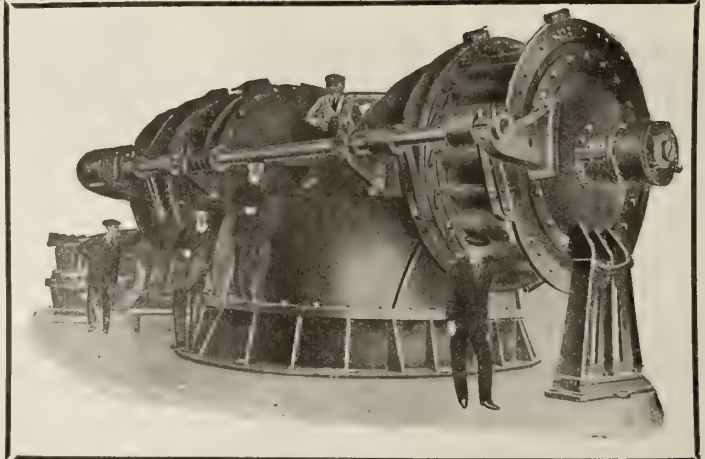

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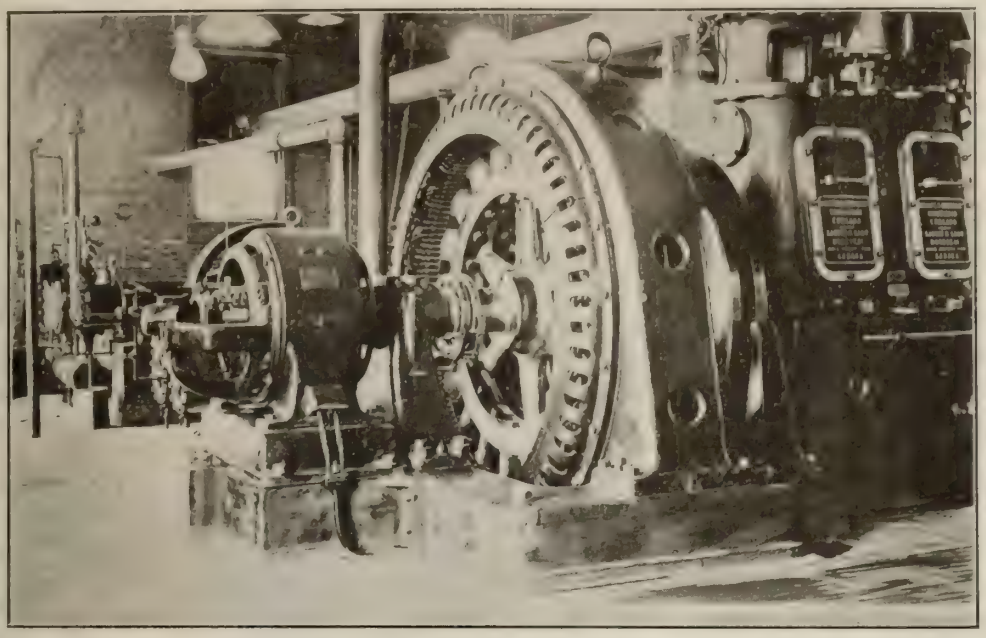
The advertiser would like to know where you saw his advertisement—tell him.

High Class Swedish Electrical Equipment



Owing to liberal design and the use of the best grade of Swedish Steel and Iron, we are able to guarantee and obtain the very best results.

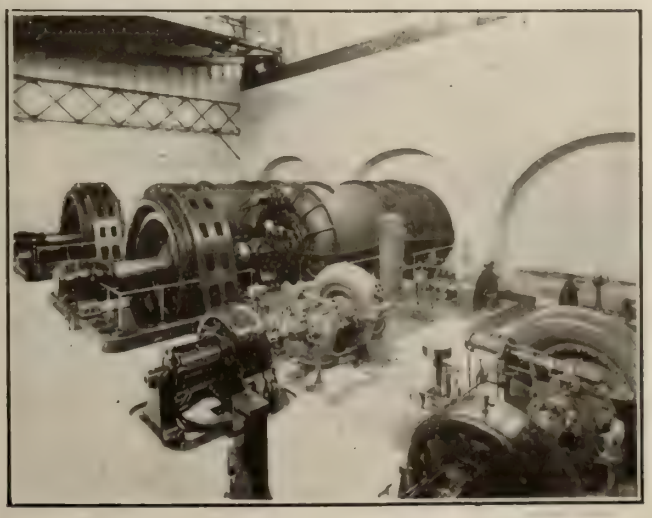
350 K.V.A. 2200 Volt, 2 Phase, 60 Cycle, 360 R.P.M., AC. Generator connected to Bellis & Morcom High Speed Engine, supplied to Corporation of Wetaskiwin, Alta.

KILMER, PULLEN & BURNHAM, Limited

Head Office : TORONTO **Branch Office : MONTREAL**

ESCHER-WYSS & CO.

ENGINEERS



HYDRAULIC
STEAM
PUMPING
PLANTS

HEAD OFFICE FOR CANADA :

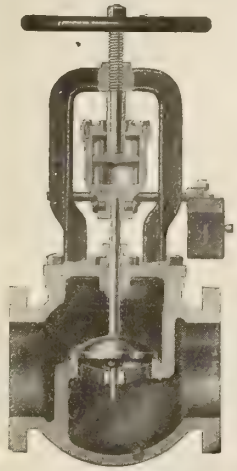
626 Coristine Bldg.,

MONTREAL, Que.

A Dependable Valve

The most important point to consider about a Stop and Check Valve is its dependability. Such a valve is supposed to protect your plant against serious damage in case of internal rupture in your boiler. But accidents of this sort do not occur frequently and the valve may not have an emergency call for months at a time. It is important therefore that you make sure about its dependability—that you *know* it will *always* work.

The Davis Class C Stop and Check Valve



Globe and Angle Patterns

was designed to entirely eliminate all the possibilities of trouble common to valves of this kind. It is doing duty in hundreds of the best equipped plants in the country and making good every day because it does not stick.

Instead of an internal steam dash pot the Davis has an external oil dash pot. Scale formation or expansion of the parts cannot affect its operation in any way. And it will not pound because the dash pot positively cushions the action of the disc no matter how slight the movement may be.

Another valuable feature of this valve is the counterweight lever. You can test it by hand and **you can see it work.** There need be no guess work about its condition. You get just what you expect and pay for if your Stop and Check Valve is a Davis—an absolutely dependable valve. Write us for descriptive booklet and list of users.

G. M. Davis Regulator Co.

434 Milwaukee Avenue, Chicago

New York
Philadelphia
Boston

Established 1875

Pittsburgh
St. Louis
San Francisco

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Reduce Your Operating Expenses With a

Westinghouse

Type Q Direct-Current Engine-Type Generator

200 Kw. 3-Wire Westinghouse Type Q Generator.

DO you realize, that a Westinghouse Q Generator, 2 or 3 wire, automatically adjusts itself to take care of all changes in load, from no load to 100 per cent. overload, without sparking at the commutator, or shifting of the brushes?

Automatic Operation means a saving to you in attendance since the generator requires no other attention than to be started and stopped.

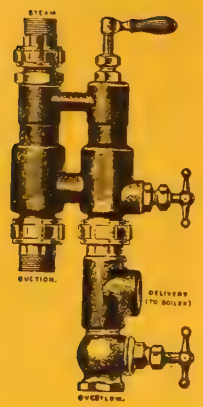
No Sparking means that the commutator takes that high polish so necessary for long life and minimum wear of the brushes. This means a material saving in maintenance of commutator and brushes.

When you buy a Westinghouse Q Generator you buy Quality.

Canadian Westinghouse Co., Ltd., Hamilton, Ontario

TORONTO Traders Bank Bldg. | MONTREAL 52 Victoria Square | OTTAWA Ahearn & Soper, Ltd. | HALIFAX Telephone Bldg. | WINNIPEG 158 Portage Ave. E.

CALGARY 311 8th Ave. West | VANCOUVER Bank of Ottawa Bldg.



Hancock Inspirator

Pop Safety Valve

Relief Valve

TRADE MARK J.M.T. REGISTERED A GUARANTEE OF QUALITY

Steam Whistle

Gauge Cock

J. M. T. Valve Renewable Disc.

Highest Quality Engineers' Supplies

We can furnish you with anything in the line of Boiler Mountings, Engine Supplies, Steam Specialties, &c., all of a class in workmanship and design for permanent service and efficiency.

Reducing Pressure Valve

Check Valve with Drip Cock

Water Gauge Mounting

Iron Pipe,
Pipe Fittings,
Branch Headers,
Heating Coils,
Steam Traps,
Low Pressure Boiler Feeder
Exhaust Heads,
Cream and Oil Separators
Feed Water Thermometers,
Steam Flue Cleaners,
Brass Railing work,
Pipe Fitter's Tools,
Etc., Etc.

Attached Cut illustrates Polished Marble Slab on Nickel Plated Brass Standards, containing our Pressure, Vacuum, Compound, and Recording Pressure **Gauges,** Draft Tube, Engineer's Clock, etc., furnished by us for one of our "Skyscraper" Buildings, in Toronto.

J. M. T. Improved Injector

Water Column with high and lo whistle Alarm.

J. M. T. Swing Check Valve, Adjustable Lift.

The James Morrison Brass Mfg. Co., Ltd.

93-97 Adelaide Street West, Toronto

Safety Valve — Lever and Weight Type.

Oil Cup—Quick Stop, Sight Feed

"Gem" Ejector.

Forked Lever Air Cock

J. M. T. Pop Safety Valve Side Outlet

Steam and Oil Separator.

Special Feature---Report of C.A.S.E. Convention

THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas Electric, Air and Water Power; and to the operation of Refrigerating Machinery.
Published by The MacLean Publishing Co., Limited.

MONTREAL: Eastern Townships Bank Bldg. TORONTO: 143-149 University Ave. LONDON, ENG.: 88 Fleet St. E.C. WINNIPEG: 34 Royal Bank Bldg.

Vol. VI. Publication Office, Toronto—August, 1913 No. 8

TRADE PENBERTHY MARK

REGRINDING BRASS VALVES

"THE ALL QUALITY LINE"

GLOBE

ANGLE

The Finest VALVE on the Market

HORIZONTAL

SWING

The Governments of
Ontario, Alberta and Saskatchewan
(DEPARTMENTS OF PUBLIC WORKS)
have approved of and registered
the high grade line of PENBERTHY all quality
REGRINDING BRASS VALVES
as suitable for Steam Pressures as high as
200 pounds.

"IT'S THE VALVE UNIVERSAL"

DESIGN — QUALITY — WORKMANSHIP — FINISH UNEQUALLED

Manufactured By

Penberthy Injector Co., Limited · Windsor, Ont.

RAINBOW PACKING

"I should worry?"

MANUFACTURED EXCLUSIVELY BY

PEERLESS RUBBER MANUFACTURING COMPANY

16 WARREN ST., NEW YORK.

FOR SALE EVERYWHERE

The advertiser would like to know where you saw his advertisement—tell him.

WATEROUS BOILERS

Every dollar you put into your Waterous Boiler you get out in satisfactory, reliable, seven-day-in-the-week service.

Waterous Boilers are built of selected materials, under hard and fast provincial boiler building laws, and are turned out in a shop where workmanship is guaranteed.

We build Return Tubular, Locomotive, Vertical, Marine and Special Types.

Our aim is to keep a large stock of standard sizes always on hand. If we cannot supply you at once from our yard we have the facilities to put your order through with the least possible delay.

Our prices are right.

The Waterous Engine Works Co.,
LIMITED
BRANTFORD, CANADA

The advertiser would like to know where you saw his advertisement—tell him.

Mr. Power Plant Owner:

Are you perfectly satisfied with the heating system in your plant?
Do you have to furnish several pounds pressure of steam to force circulation?
Do you suffer expenses from delay, low efficiency and repairs due to freeze-ups?
Do you require the attention of an engineer or other expensive man to doctor various parts of the system in order to get momentary result?
Think it over!

A Dunham Vacuum System Will:-

Insure heat in every radiating unit without loss of steam.

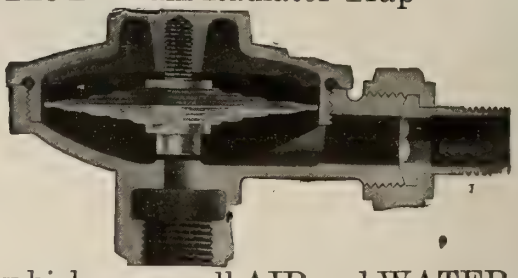
Eliminate all troubles from freeze-ups.

Reduce back pressure on your engine to a minimum (means greater engine economy).

Effects a large saving in your coal bill.

By Use Of

The Dunham Radiator Trap



which passes all AIR and WATER, closes off against STEAM, and proven durable by years of service.

Let us direct you to many satisfied customers who have changed their old unsatisfactory, troublesome system into a Dunham.

Our Engineering Staff is at your disposal

C. A. DUNHAM CO., LTD., Toronto, Can.

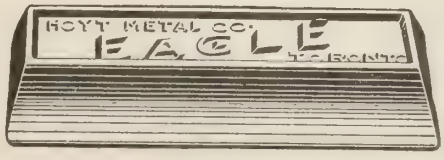
Halifax Montreal Vancouver Winnipeg Calgary

Sales Over Five Million Dollars Annually

Four Babbitt Manufacturing Plants

TORONTO LONDON, ENG. NEW YORK ST. LOUIS

Faultless "A" This babbitt is a high grade copper hardened alloy, possessing in a higher degree all the good points of the original Genuine Babbitt, with increased antifriction qualities, having the additional merit of absorbing and holding oil. It is used extensively in France for automobile engines, and in South Africa for mining machinery, and in United States and Canada for marine engines, dynamos and all heavy duty machines. Where heavy service is required this will last longer than any Genuine Babbitt manufactured. For heavy duty, saw mills and engines it is without equal.



Eagle "A" Thousands of tons of this alloy have been placed on the market, giving such perfect results, that it's name and merits are known, we believe, as extensively as any other babbitt manufactured. Its high antifriction and heavy duty qualities make it especially adapted for saw-mills, planing-mills, threshing engines, traction engines, pumps, rolling-mills and general machine shop use.

HOYT METAL COMPANY

TORONTO OFFICE AND MFG. PLANT—EASTERN AVE. AND LEWIS ST.

JENCKES BOILERS

Will Minimize Your Stoppage For Repairs

HORIZONTAL TUBULAR
VERTICAL TUBULAR

LOCOMOTIVE TYPES
HEATING BOILERS

Jenckes Boilers are built to stand severe service.

Flange quality steel, conforming to Manufacturers Standard Specification, is used in sheet and heads. The tubes are lap welded steel of standard gauge and make; the rivets of special quality rivet steel, and the stays of steel, without welds.
Jenckes Boilers are built to conform with the various provincial inspection acts—every one is tested under high pressure before leaving works.

We will take pleasure in getting you in touch with users. Why not benefit by their experience?

Ask for Catalog.

The Jenckes Machine Co., Limited

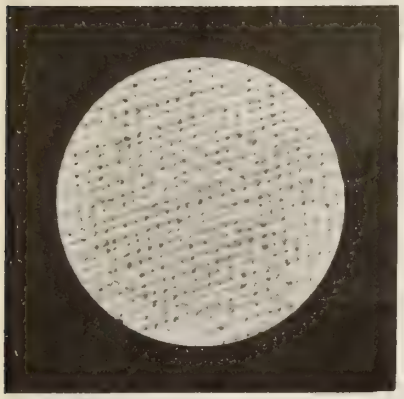
Sherbrooke Montreal St. Catharines Cobalt
South Porcupine Nelson Vancouver

Works: SHERBROOKE, QUE.
ST. CATHARINES, ONT.

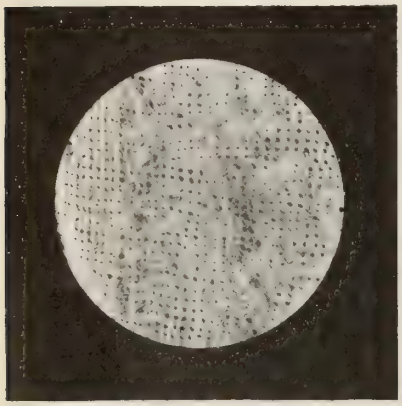
The advertiser would like to know where you saw his advertisement—tell him.

"FILTERING CLOTHS

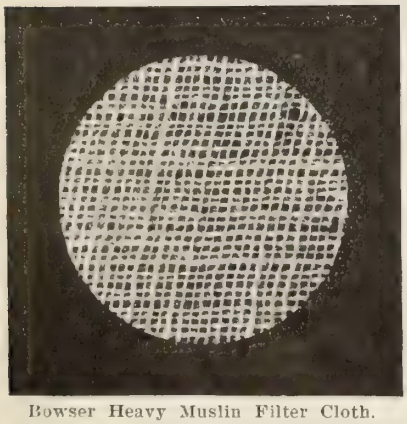
Study the pictures given below and note the differenent textures of the cloths used for filtering. The cloths shown in the photograph are all magnified three times."



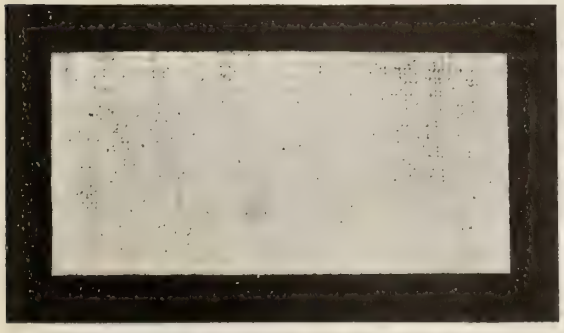
Cheese Cloth which is most commonly used.



Cant [illegible] Closely Woven Cloth very often used in ordinary filters.



Bowser Heavy Muslin Filter Cloth.



Bowser Cambric Filter Cloth for exceptionally fine filtering.

BOWSER Collapsible Oil Filter

Filtration is a matter of degree, anywhere from coarse to fine. Fine filtration demands fine filtering surface. If fine filtering surface be used, it must have a large area and in order to secure large filtering surface, it must occupy small space. The Bowser Filters are the only collapsible filters.

The Bowser Filter Extended.

Every Inch is Uniformly Effective

However, a Bowser System does not depend upon filtration alone to cleanse the oil. With it oil passes through a precipitation compartment, then through a fine screen compartment and thence, under a pressure head, to the closely woven cloth filters previously described, which provides two and three-fourths square feet of surface for each gallon of oil per hour to be filtered.

The capacity of the filtering surface, when clean, and the pressure head at its full height, 36 inches, is over two thousand times the nominal rating.

Write now for complete details. It will not obligate you in any way and may save you many dollars. Systems for large and small power plants at all prices, styles and sizes.

S. F. BOWSER & CO., Inc.

66-68 Frazer Ave. **Toronto, Ont., Canada**

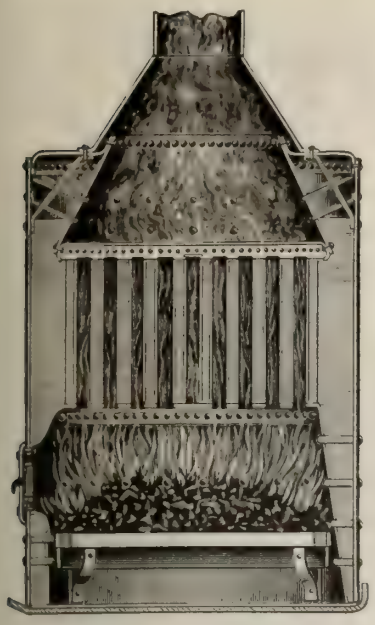
MADE BY CANADIAN WORKMAN AND SOLD BY CANADIAN SALESMEN

Sales Offices in all centres and Representatives everywhere

Original patentees and manufacturers of standard, self-measuring, hand and power driven pumps, large and small tanks, gasolene and oil storage and distributing systems, self-registering pipe line measures, oil filtering and circulating systems, dry cleaner's systems, etc.

Established 1885.

The advertiser would like to know where you saw his advertisement—tell him.



You Will Benefit By

a thorough investigation of our boilers.

They are the result of long experience, best materials and expert supervision.

Look up the past and present record of our boilers.

We will take the greatest pleasure in getting you in touch with some users—the evidence of users will cost you nothing. Our boilers will do the same for you as they do for others.

WRITE TO-DAY.

We build various types:

Scotch, Clyde, Fitzgibbon, Vertical, Mosher.

Highest Grade BOILERS

Horizontal, Tubular, Vertical, Locomotive Type. "Heine" Water Tube.

Polson Iron Works,

LIMITED

Steel Shipbuilders, Engineers and Boilermakers

TORONTO, CAN.

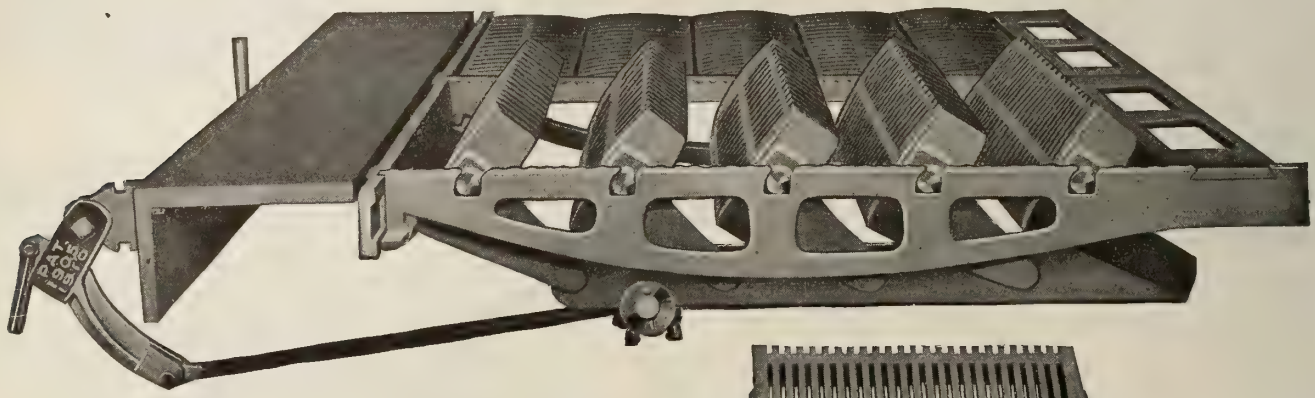
Representatives in Canada for

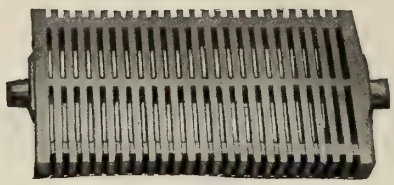
The B. F. Sturtevant Co., Hyde Park, Mass., U.S.A. Fans, Blowers, Heating and Ventilating.

The John I. Thornycroft Co., London, Eng., Marine Motors.

"THE Cyclone"

Shaking and Dumping Grate Bar





A Positive Guarantee of Maximum Service and Fuel Economy

The "Cyclone" embodies an immense improvement in the shaking apparatus, whereby **all** the ashes are passed through the grate—no fuel can possibly go to waste.

Burns the cheapest grades of fuel with results equal to that of the best.

Locks Level. Cannot get out of adjustment or become warped.

The "Cyclone" allows 68 per cent. of air space, and 90 per cent. underdraught —this greatly increases the production of steam for amount of fuel used.

Make sure you get the Genuine "Cyclone." They are imitated in construction, but unequalled in quality.

The experience of users should be of interest to you—we will be pleased to get you in touch with some of them.

WRITE TO-DAY

The Canadian Steam Boiler Equipment Co., Limited

SOLE MANUFACTURERS FOR CANADA

211 QUEEN STREET EAST :-: :-: :-: TORONTO, CANADA

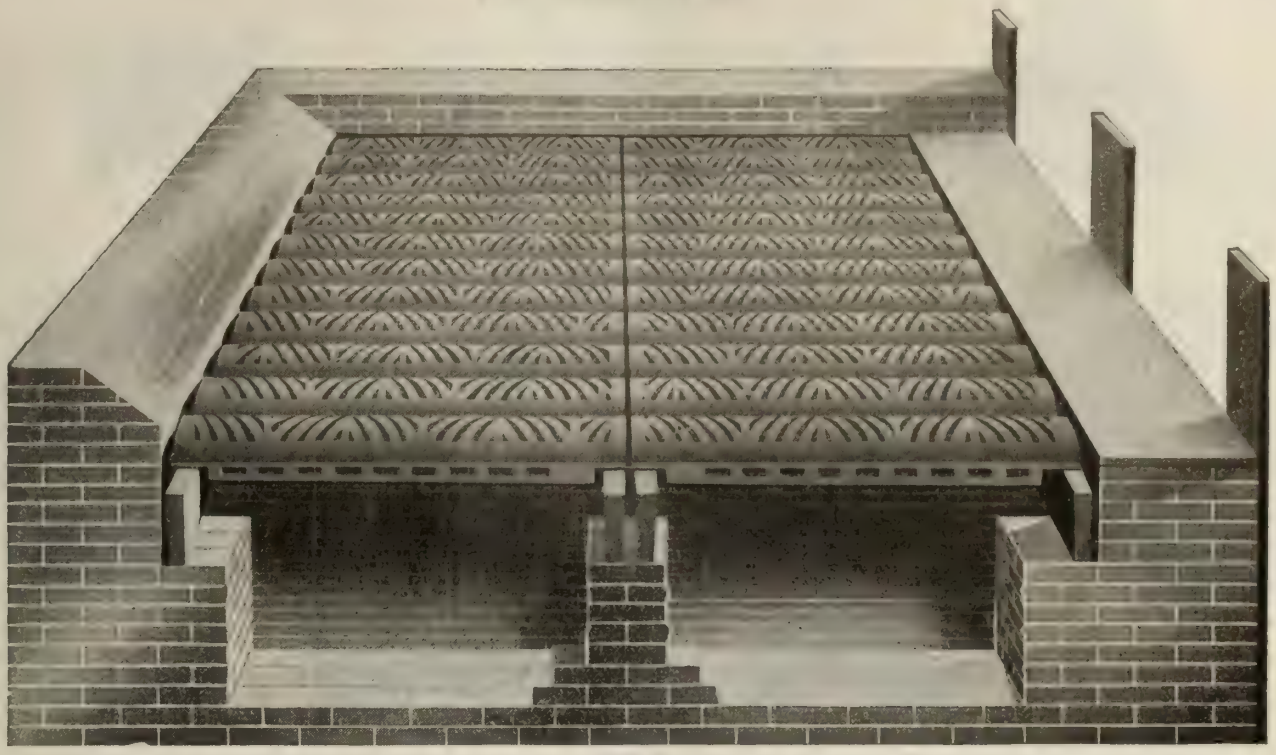
AGENTS

ST. JOHN, N.B., F. W. Blizard, Canada Permanent Chambers. MONTREAL, H. L. Peiler & Co., 308 St. James Street.
HAMILTON, Robt. Fitzsimmons, 8 Grove Street. CALGARY, Alta., The Western Foundry & Metal Co., Limited.
BERLIN, J. Hainsworth, 14 Foundry Street. WINNIPEG, Vulcan Iron Works.

THOMAS ELLIPTIC GRATE BARS

SHAKING—CIRCLE—STATIONARY

FOR EVERY FUEL



THOMAS IDEAS

PATENTED

THOMAS ELLIPTIC GRATE BARS	INCREASE STEAM—SAVE FUEL—SAVE LABOR —COST LESS—REDUCE SMOKE.
THOMAS GRATE RESTS	EVERLASTING—PRESERVE GRATE BARS—PROTECT FIRE WALLS.
THOMAS FURNACE SETTING	FIRE WALLS—BRIDGE WALL—FRONT WALL independent of all expanding and contracting irons. SEE THAT AIR SPACE COMPLETELY ENCIRCLING THE GRATE AREA. No dead and burned grate bar ends. No pushed down walls from expansion of grates.

Shipped from Hamilton, Ont. **Let us give you complete information.**

FOR ALL PROBLEMS

Steam—Grate Bar—Furnace—write THOMAS

The General Supply Co. of Canada, Ltd.

OTTAWA **TORONTO** **WINNIPEG**

THOMAS GRATE BAR CO., **Birmingham, Ala., U.S.A.**

JENKINS·BROS·VALVES·

TRADE JENKINS MARK

Jenkins Bros.

Fig. 475

Fig. 476

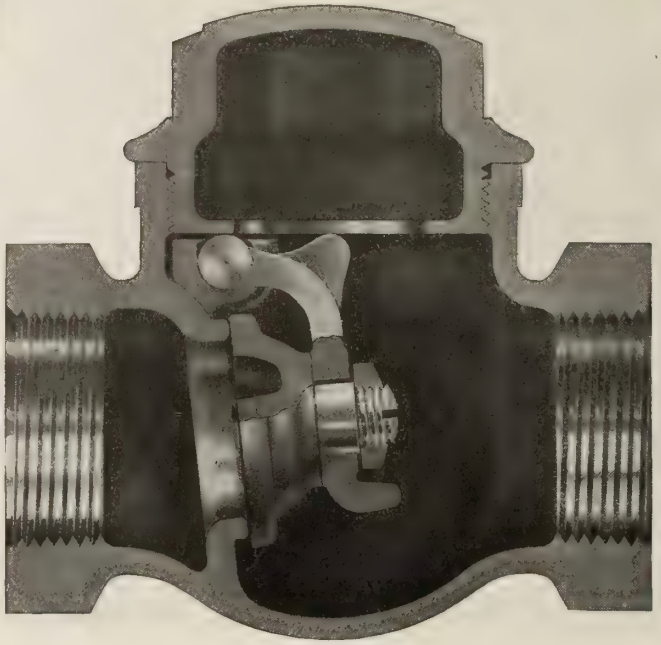


Fig. 475 (Sectional)

Brass Swing Check Valves

TYPE "K"

Standard Pattern

In the design of these Check Valves a departure has been made from the old design of valve, in which the disc is attached to a hanger supported by a pin held in place by one or more lugs screwed into the side of the valve body. The Type "K" Valve is provided with a hanger, having the pin cast solid and forming a part thereof and the ends, accurately turned, rest in bearings cast in the body—the flange on the lower side of the cap serving to keep the pin in place, and at the same time allowing the hanger to swing freely—insuring perfect closing.

For regular service the dics are of bronze, but by simply removing the cap and lifting the hanger, you can replace same with a disc-holder containing a Jenkins' disc—hard for Steam or Hot water or a soft disc for Cold water.

These valves are splendidly adapted for boiler feed service and similar work, as they offer no obstruction to the flow of steam or fluid. Approved by The Depts: of Public Works for use in Ontario and the Western Provinces.

Catalogue Sent Free Upon Request.

103 St. Remi St. JENKINS BROS. Limited Montreal

The Dart Union Pipe Coupling

EASILY CONNECTED

NEVER Leaks, Rusts Or Corrodes

REDUCES EXPENSE

Dart Unions can be used over and over again because their efficiency is not affected by connecting and disconnecting. They positively eliminate all loss due to leaks.

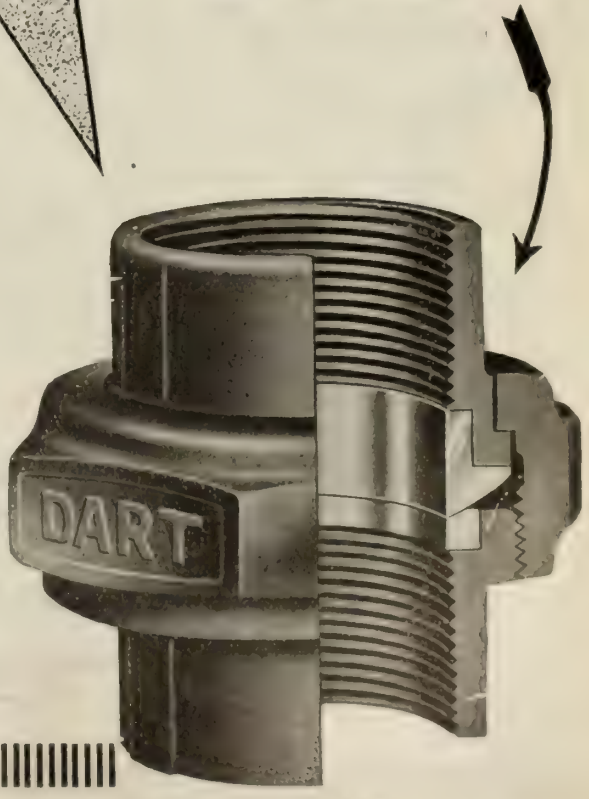
Have no maintenance cost, and do not have to be replaced.

They make joints easily and quickly whether pipes are in or out of alignment, and are not affected by contraction, expansion or vibration.

Our trade mark is cast on every union —it's your guarantee. If any union bearing this mark is found defective we will promptly replace it with two new ones.

Your jobber has them in all convenient types.

Bronze to Bronze at the Joint

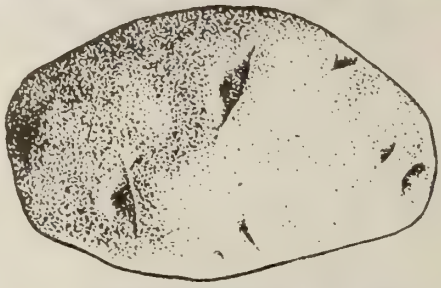


Dart Union Co., Limited

TORONTO, CANADA

The advertiser would like to know where you saw his advertisement—tell him.

POTATO SCALE



BOILER CLEANSER

Saves Tubes **Saves Fuel**

The Only Real Boiler Compound

IT WILL ABSOLUTELY RID YOUR BOILERS OF ALL SCALE OR DIRT

We guarantee this boiler cleanser to remove all scale, and if a small quantity is used continually, it will prevent any new scale from forming.

The ingredients used in its composition are harmless to metal.

Send for sample keg and try it, if not satisfactory you don't need to pay for it.

Thousands are using it and we have no dissatisfied customers.

IT GIVES SATISFACTION EVERYWHERE

Ask for a sample of our
NUMIDIAN CYLINDER, VELOX ENGINE and SLIPTIVITY MACHINE OILS

These oils form a triple combination that is hard to beat. Once you have tried them we are confident of your regular patronage.

C. C. SNOWDON

1810-1840 11th STREET EAST, CALGARY, ALBERTA. P.O. Box 1384

Refiner, Importer and Manufacturer of

Pennsylvania Lubricating and Refined Oils, Gasoline, Potato Scale Powder, Liquid Soap, Disinfectants, Polish, Waste, Oil Tanks, etc.

Why Not Try

Perolin

The German Boiler Metal Treatment

Warranty

We Guarantee PEROLIN the German Boiler Metal Treatment

1. To remove scale already formed in your boilers.
2. To prevent new scale from forming.
3. To stop all pitting, corroding and galvanic action.
4. Not to corrode or injure the boiler metal or packing.
5. Not to affect or impart any off-odor to steam generated from the water.
6. To correct oil troubles caused by oil or grease getting into boiler water.
7. Not to affect the product of Breweries, Ice Plant, Creameries, Dye Works, or any Product where live steam is used in the manufacture of their goods.
8. That it does not affect the water, neither is it affected by the water and that the Perolin Preservative Film is a good transmitter of heat.

If **Perolin** were not in a class by itself and the only Boiler Treatment made that does all the work all the time, at all places, regardless of water conditions, and at the least cost, we would not be taking your time to tell it, and would have no claim on your attention.

Perolin acts on the iron through its affinity for the metal, putting it in a condition to absolutely throw off all the old scale and prevent any new scale from adhering, holding the solids in suspension, so that they can be removed through the blow-off pipe. Water is a constantly varying quantity as to solids in solution, while iron is permanent the world over.

To treat all the water used in a boiler requires a much greater quantity of ordinary water-treating boiler compound than **Perolin**, which acts only on the iron and remains in the boiler. The economy of **Perolin** is therefore self-evident, as we are not treating the water, which is being constantly evaporated.

Perolin is not a new thing, has been used for 18 years throughout entire Europe, and during the last 3 years 28,000 boilers have been secured through the United States in the largest and most up-to-date plants.

We are prepared to ship by freight prepaid sufficient quantity of **Perolin** to conduct a 60-day test in your plant, upon the understanding that you use it as we direct. If it does not accomplish the results we guarantee in our warranty, return what you have left, and we will cancel all charges against you, making the test cost you nothing.

Please remember the burden of proof is up to us. We need you and you need us. We hope you will give us an opportunity to prove that our interests are mutual. If the statements we make are facts, we believe you want to know them to be such, and we stand ready to demonstrate them.

Perolin Company of Canada Limited

Standard Bank Building - - Toronto

Stop Blow-outs and Leaks in Pipe Lines by Using GOETZE No. 2 ELASTIC GASKETS

If you start right now to renew with No. 2 ELASTIC GASKETS, you can steadily reduce your renewals until you have brought them almost to the vanishing point.

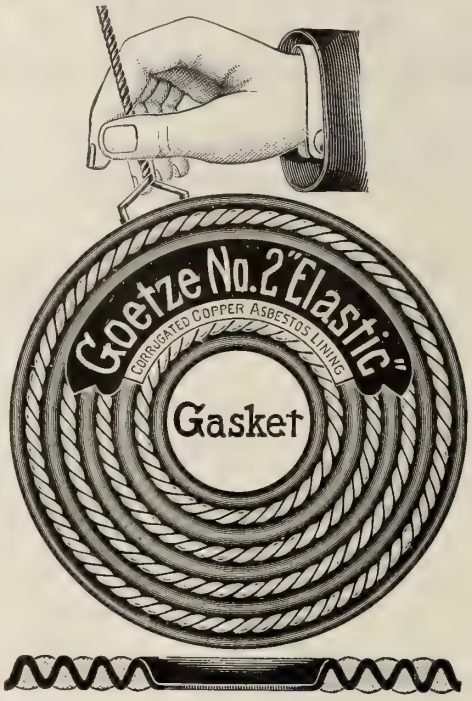
This is not a mere "claim"—it is backed up by a *guarantee*—in fact the strongest guarantee ever made by a gasket manufacturer.

Think what it means to re-gasket a joint so it will *keep tight for years,* instead of days or weeks. Think of the saving resulting in gasket costs, labor and shut-downs.

What No. 2 Elastic Gaskets Will Do

No. 2 ELASTIC GASKETS will make the most troublesome joint you have absolutely tight — and keep it so. They "stay put" and stay tight. Prevent leaks, blow outs and shut-downs. Will practically eliminate renewal expense for gaskets.

No. 2 ELASTIC GASKETS are for high pressure and super-heated steam lines, but owing to their indestructible nature, are equally adapted to *any and every condition* about a factory, mill or refinery.



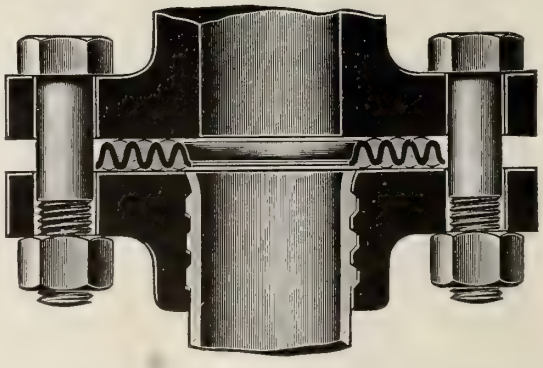
The No. 2 Elastic Guaranteed

Every No 2 Elastic Gasket is Guaranteed for 5 Years Continual Service in the Same Joint

There are no "ifs and ands" about this guarantee. It means just what it says. It applies to every No. 2 GASKET whether bought direct from us or through a dealer.

How No. 2 Elastic Gaskets are Made

These Gaskets are made of corrugated copper with asbestos lining No. 2. The corrugations allow for expansion and contraction of the pipes, while the asbestos, being forced into the



pores of the metals in the flanged surface by the "squeeze" and the constant pressure of the corrugations beneath it, holds securely against the highest pressures.

Goetze Gaskets are carried in stock by

T. McAVITY & SONS, LIMITED

ST. JOHN, N.B.

MONTREAL
112 St. Peter Street

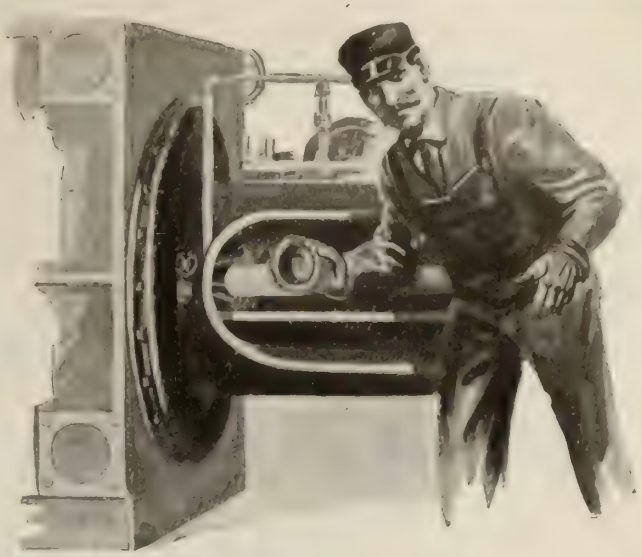
BRANCHES AT
WINNIPEG
C. E. Chown, 147 Bannatyne Street

VANCOUVER
c/o A. O. Campbell, 1069 Hamilton Street,

MANUFACTURED BY

Goetze Gasket & Packing Co., New Brunswick, N.J.

"I Just Add A New Ring"



If after months or a year, a rod packed with P. P. P. should "blow" a little, just put in another ring—this will mean a whole lot more service.

P. P. P. lasts longer than any other fibrous packing; it saves over 75 per cent. of the unnecessary friction caused by "solid" packings. This saving is effected by the "sliding wedges" and "compressible cushion."

DANIEL'S ROD PACKING **P. P. P.** COIL RING SPIRAL

An actual test showed that it required fifty per cent. more frictional horse-power to run an engine with high-grade ring packing than that required to run it with P. P. P. and **fifty-nine per cent. more frictional horse-power** to run it with the gum-core packing than with P. P. P. Packing, producing a saving by the use of P. P. P., in the case of the high-grade ring packing, of 1.96 horse-power, and a saving over the gum-core of 2.31 horse-power; hence, if you know the cost per horse-power per annum in your plant you could easily figure the sum that P. P. P. Packing would save in your fuel account each year, running under similar conditions.

A West Virginia chief engineer writes: "I have been using Daniel's P. P. P. Rod Packing for seven years, and I find it gives longer and better service than any packing I have ever used. Have tried several other brands, but recommend your P. P. P. as the best for service and durability."

How to Get the "Slide Valve" FREE

Fill out the Coupon, and mail it to us. We will address a book to you, and send it FREE of charge.

Your Name .....

Address .....

Employed by .....

Address .....

Horsepower of Engine .....

Kind of Rod Packing Used .....

Do You Use **EBONITE** Sheet Packing? .....

Dealer's Name .....

Address .....

Name of Buyer .....

.....Series 24-H

Daniel's P. P. P. Rod Packing is imitated more than any other packing made. But the imitation is in appearance and claims only. None but the genuine gives the results

QUAKER CITY RUBBER COMPANY

Manufacturers of Mechanical Rubber Goods

PHILADELPHIA, PA., U.S.A.

The advertiser would like to know where you saw his advertisement—tell him.

From Punta Arenas to Ketchikan You Can Find Magnolia Metal

Apsley Rubber Co.,
Hudson, Mass., Sept. 30th, 1911.

Gentlemen:—

In reply to your letter dated Sept. 18th, I have to state that my experience with MAGNOLIA METAL in the past, when I was Chief Engineer, at sea, is wholly in its favor, and I shall at all times advocate its use. On the "S.S." Hesione, of Liverpool, I had to get a crank pin brass re-metalled at Buenos Ayres, 18 in. x 18 in., and when I left the ship three years later, it was in excellent condition, the wear extremely small, and the running conditions most satisfactory. This also applies to a guide shoe re-metalled at the same time, in addition to many other places where I have had experience of its qualities.

Yours faithfully,
F. W. WADBROOK,
Chief Engineer.

SOLD BY LEADING DEALERS EVERYWHERE OR BY

MAGNOLIA METAL CO.

OFFICE AND FACTORY:
225 St. Ambroise St. MONTREAL

Will Transmit Your Power With Efficiency and Economy

This belting is made from the centre of selected hides which are tanned by the **real British oak slow process**—the process which is acknowledged as the best. Absolutely no shoulders, necks or bellies are used. The selection of hides and the complete manufacturing process is under our personal supervision.

This belting stretches less in service because it is well stretched before being offered to the trade. It means positive transmission of power because the grip on the pulley is efficient. Every piece of D. K. McLaren's belting is trade marked — it's own guarantee of satisfactory service.

Montreal
351 St. James St.

Toronto
200 King St. W.

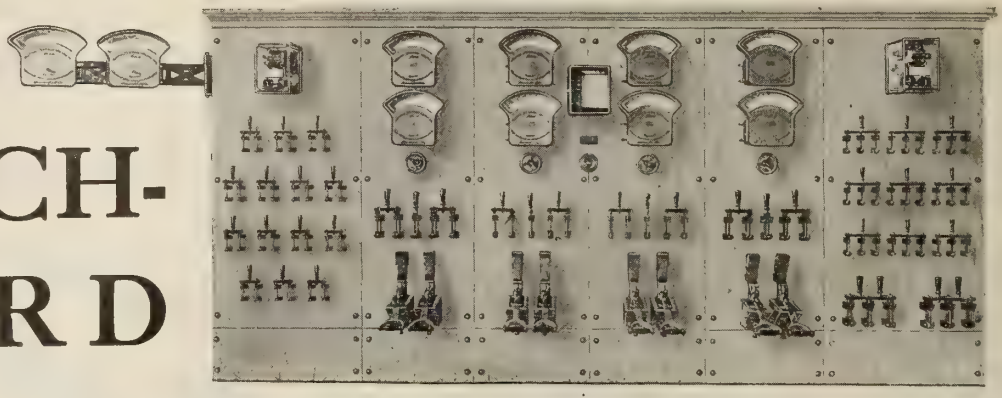
D. K. McLAREN
Limited

Vancouver
37 Alexander St.

St. John, N.B.
64 Prince William St.

The advertiser would like to know where you saw his advertisement—tell him.

THIS SWITCH-BOARD



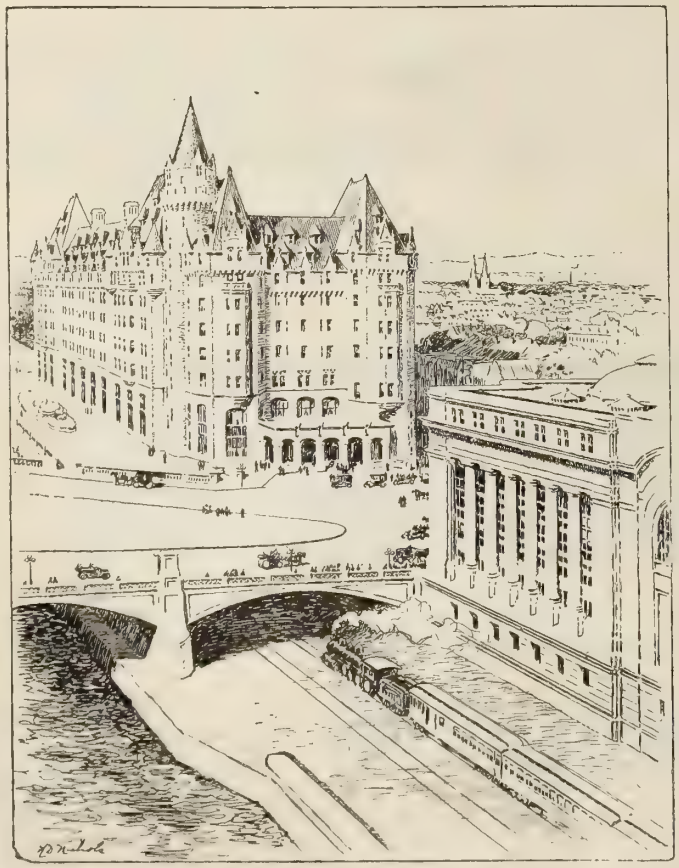
Was made by us for the new head office building of the Bank of Toronto. Expert knowledge and practical experience are combined in its design. It is constructed to give satisfactory service under all conditions.

We will gladly furnish information regarding switchboards or electrical equipment of any kind. Write our nearest house.

THE Northern Electric AND MANUFACTURING CO. LIMITED

Manufacturer of Telephone and Fire Alarm Apparatus and Distributor of Electrical Supplies for every possible need.

MONTREAL HALIFAX TORONTO WINNIPEG REGINA CALGARY EDMONTON VANCOUVER



Across Canada

with the

IMPERIAL WIRE and CABLE COMPANY, LIMITED

Toronto MONTREAL Winnipeg

Second of a series of advertisements showing buildings of national importance which have been wired with Imperial Wire & Cable Co.'s, Limited, wires.

This picture shows

CHATEAU LAURIER and GRAND TRUNK CENTRAL STATION OTTAWA

These buildings were wired throughout with "ADANAC" Rubber Insulated Wire.

Architects: Ross & McFarlane, Montreal.
Engineers: Westinghouse, Church, Kerr & Co., New York.
Electrical Contractors: Western Electric Co., New York.

Address our nearest office

MONTREAL TORONTO WINNIPEG

Alberta and British Columbia inquiries may be addressed to our Sales Agents, the Northern Electric and Manufacturing Co., Limited, Calgary and Vancouver.

Catch Trouble by the Forelock

Get a supply of **Garlock Palmyra Red Sheet Packing** for your Steam Lines, Cylinder Heads, Steam Chest Covers.

Don't Worry

Be Prepared

This sheet packing is made of high grade rubber compounded in such a way as to give it great strength and reliability. It has met with universal success and has established a wide reputation on its own merits. Write for samples and prices.

Have you a Garlock catalogue?

The Garlock Packing Company

HAMILTON, ONTARIO

Montreal Toronto Winnipeg

Pioneers in the Packing Business

The advertiser would like to know where you saw his advertisement—tell him.

Sunbeam
MAZDA

Drawn Wire
Tungsten Lamps

Will reduce your lighting costs and by giving a much clearer light than is possible with carbon lamps they will increase the quality and quantity of your daily output.

Your employees cannot be efficient if your plant is improperly lighted.

Sunbeam Lamps are durable.

Vibration does not affect them.

The Canadian Sunbeam Lamp Co., Limited

Main Office and Factory: TORONTO

Branch Warehouses:
MONTREAL, WINNIPEG, CALGARY, VANCOUVER

Use Stephenson Bar Belt Dressing

Make 1913 a record breaking year. Turn over a new leaf and get rid of the things that have been causing needless trouble and expense. Adopt the things which will make your work easier, give better results and save money for your employer. You cannot start at a better place than with your belt dressing.

Get rid of your troublesome liquid dressing. Shake the can for the Stephenson solid stick and shake trouble at the same time.

Stephenson Bar Belt Dressing is a friend in need. It doesn't require preparation, nor do you have to use special care in applying it. The minute the belt slips you hold the Stephenson bar to the belt for a few seconds and the slipping stops. There's no waste—no slop—no smearing on of paste or pouring on of spattering liquid. And the results are better.

I'll "Stick to the Solid Stick"

Start With a Free ½ Lb. Sample

Simply send us your name and address and we ll send you a present in the shape of a free half-pound sample of Stephenson Bar Belt Dressing.

Remember—we give you this sample absolutely free of charge. Get this free half-pound of the finest belt dressing made and test it. Here's your chance to try somesomething really good at no expense.

None Genuine Without Trade-Mark

Stephenson Manufacturing Company

Est. 1888 Albany, N.Y. Inc. 1897

The advertiser would like to know where you saw his advertisement—tell him.

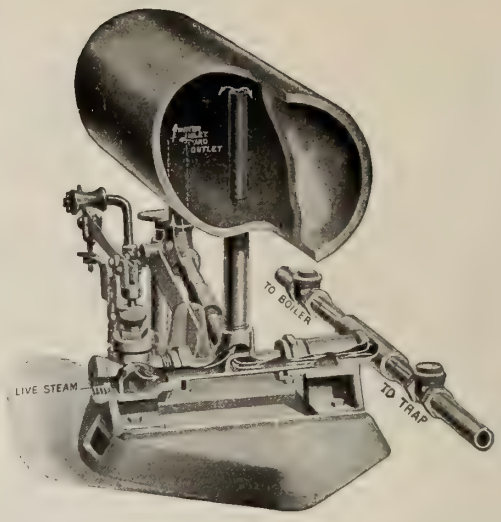
From 20 to 40% of the Heat Units in the Water of Condensation is Lost by Cooling the Condensation down to Accommodate a Steam Pump.

Morehead Traps return the condensation with its full heat content direct to your boiler with practically no drop in temperature.

This is a rigid, compact and very simple trap which works by gravity.

It effects big savings in coal bills.

For over 23 years they have been producing results everywhere—results that are unequalled by any trapping system



Morehead Back to Boiler SYSTEM

There is a MOREHEAD TRAP for any kind of service.

Send for a "Trial Trap" and see how quickly the Morehead System will show savings in your coal bills, repair expenses, etc., and improve your heating system.

Write us to-day.

The Canadian Morehead Mfg. Co., Ltd.
WOODSTOCK, ONT.

Save Fuel and Increase Profit

A few engineers find this a difficult problem. They are not acquainted with

The "OTIS"

TUBULAR FEED WATER HEATER, OIL SEPARATOR AND PURIFIER

The exhaust steam when harnessed and passed through this Heater will heat the Feed Water to a boiling point before it enters the boiler. This effects an enormous yearly saving in fuel.

Write for descriptive catalog and prices.

The STEWART HEATER CO.
189 Norfolk Ave., Buffalo, N.Y., U.S.A.

THE CANADIAN CASUALTY AND BOILER INSURANCE COMPANY

This Company makes a specialty of inspecting boilers under construction, and issues an official Certificate of Inspection, as required by the Laws of Ontario which came into force on the 1st July.

CONTINENTAL LIFE BUILDING
TORONTO

J. O. B. Latour, Chief Engineer.
John J. Durance, Manager.

Phone Main 6941

The advertiser would like to know where you saw his advertisement—tell him.

6,000 H.P. Hydro-Electric Plant

POWER PLANTS, ROLLING MILLS, MINING, HOISTING MACHINERY

ELEVATORS PATENT "STIGLER"

Builders under patents of "STE. ALSACIENNE"

Belfort (France) Mulhouse Graffenstaden (Germany)

Engineering Works of Canada

Head Office: 805-6 New Birks Bldg.

MONTREAL, Quebec

Here's Another Way To Meet Crowded Conditions In City Buildings

Jeffrey Telescopic Ashes Elevators

For handling ashes from sub-basements or boiler rooms

These elevators are built with economy as the keynote of construction. They occupy minimum space—have few movable parts to wear out—ashes are carried direct from furnace to wagons or railroad cars without re-handling.

When not in use, the elevator is lowered by its own machinery and disappears below the walk or pavement.

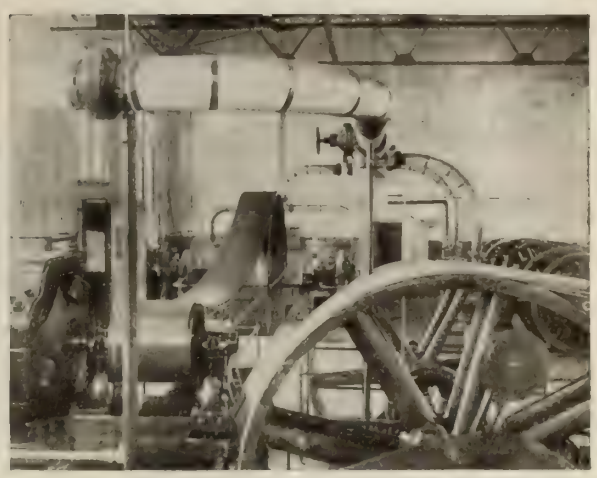
Our STANDARD Designs can be adapted to meet your requirements.

Write for complete information and Catalog No. 32-A.

JEFFREY MANUFACTURING COMPANY

Canadian Works and Main Office, MONTREAL

Winnipeg Representatives, N. J. DINNEN & CO.



One Belt Peeled; One Belt Slipped. Cling-Surface Stopped The Trouble In Both.

This engine room (Hanover Light, Heat and Power Co.) contains two belts, both of which have received Cling-Surface treatment. One, a 36 in. belt, transmits 350 to 400 h.p.; the other, a 32 in. belt, transmits a load often fluctuating from 100 to 500 h.p. within a few seconds. The manager of this plant, Mr. R. E. Manley, writes:

"The first belt never gave trouble from slip, but the surface was peeling. Cling-Surface has helped greatly. The second belt slipped, was kept tight and despite several dressings still slipped. Cling-Surface stopped slipping entirely."

The latter belt and its sag while running under Cling-Surface treatment are shown above. Generator pulley is 38 in., engine pulley, 14 ft.; center distance 30½ ft. and the belt speed 3738 ft. per min.

The fact that different troubles disappeared on each belt proves conclusively that Cling-Surface is a **natural belt food**, not a mere surface treatment to stop slip temporarily.

We can show you many instances where Cling-Surface has more than doubled the life of a belt and paid for itself hundreds of times over.

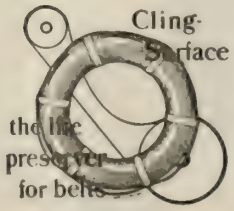
We can show you where Cling-Surface has permitted the reduction of bearing loads and a consequent saving that makes the cost of Cling-Surface treatment look like nothing.

We can show you where Cling-Surface-treated belts, once run tight, now run so slack that the reduction in lubrication expense alone more than pays for the Cling-Surface treatment.

We can show you places where Cling-Surface has saved enough in preventing belt breaks and shop shutdowns to pay for all the Cling-Surface required by several generations of belts.

Cling-Surface treatment is so inexpensive and so simple and can do so much that you cannot afford to do without it.

Make the trial at our risk. Send for our guarantee and literature. Quotations are f.o.b. Toronto.



Cling-Surface Co

1057 Niagara Street

Buffalo N Y

57

The advertiser would like to know where you saw his advertisement—tell him.

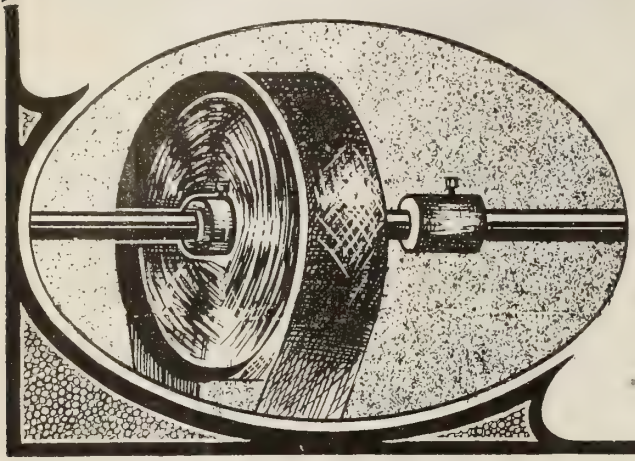
SPARTAN BELTING

Repeatedly Outwears Three Ordinary Belts—It's Not Affected by Steam, Water, Oil, Gas or Acid Fumes and Is Especially Adapted For Any Hard Service

For service under abnormal conditions where the life of the average belt is limited frequently to weeks, the Spartan has swept all before it, repeatedly outwearing three ordinary belts, obviating expensive shut-downs.

Spartan Belting, by its thousands of users, is conceded to be without an equal for successfully meeting the most exacting requirements.

Why not pick out one of those exacting or troublesome drives in your plant and let us prove to you the efficiency of the **Spartan Brand?** Anyhow let us send further particulars, together with copy of our Spartan Book. **Write to-day.**



1851 G & K TRADE

The Graton & Knight Mfg. Co.

Oak Leather Tanners and Belt Makers,

Worcester, Mass., U.S.A.

Note: **There is a G & K belt for every drive.**

ALL BEARINGS REAMED

The "Bond" Patent Universal Ring Oiling Ball and Socket Hanger

SOLE CANADIAN MANUFACTURERS

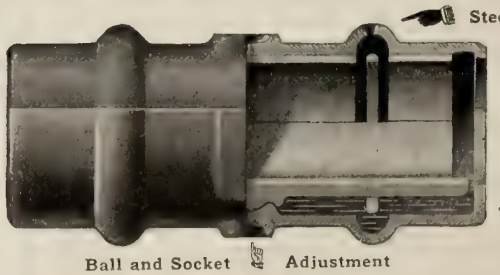
Canadian Bond Hanger and Coupling Co., Limited

ALEXANDRIA, Glengarry County, ONTARIO

The Hanger from Glengarry is the **"BOND,"** universally admitted to combine the best of everything **—DESIGN, MATERIAL, WORKMANSHIP, RESULTS.**

Note the **PERFECT BEARING, MINIMUM FRICTION** and consequently **POWER AND FUEL SAVED.**

It will be a pleasure to mail you Catalogue of our extensive manufactures on demand. Write us at once and save money on your equipment.



The advertiser would like to know where you saw his advertisement—tell him.

Are Your Pulley Requirements Harder or More Varied Than These?

In the plant of the Excelsior Motor Mfg. and Supply Co. of Chicago, makers of "Excelsior" Auto-Cycles, an

"AMERICAN" STEEL SPLIT PULLEY

Perfect in principle Powerful in performance

is used in running a line of polishing and buffing machines. One moment there is no resistance except the belt traction—the next, ten to fifteen men will be at work polishing, exerting an aggregate pull of fifty horse power. The pulley does this work and stands up to it.

In making dynamometer power and speed tests for motor-cycle engines the "Excelsior" people use "American" pulleys exclusively because of their lightness and strength. ¶ Another "American" has done 10-inch belt duty on a motor driven air compressor for 4 years —a task requiring extreme endurance.

This company has used several hundred "American" pulleys for 4 years **without one cause for complaint.**

The case of the Excelsior Company is no exceptional one. In hundreds of plants "American" pulleys are performing even harder tasks and fulfilling in every way our guarantee of double belt service under any conditions not requiring a special pulley.

PATENTED

THE AMERICAN PULLEY COMPANY

OFFICE AND WORKS: PHILADELPHIA, PA.

A large stock of "American" steel split pulleys are carried at the following warehouses, insuring prompt shipment to customers:

CANADIAN AGENTS:—Williams & Wilson, Limited, Montreal, Quebec; A. R. Williams Machinery Co., Limited, Toronto, Ont.; St. John, N.B.; Winnipeg, Man.; Calgary, Alta.; Vancouver, B.C.

"Maple Leaf" Brand

Stitched Cotton Duck Belting

THE BEST FOR ALL KINDS OF BELTS

Means Reduced Upkeep Expense and Efficient Service

There is a "Maple Leaf" Belt for every service from the heaviest drive to the smallest light belt.

It is durable under dry or wet conditions, and is by far the most economical belting that you can use.

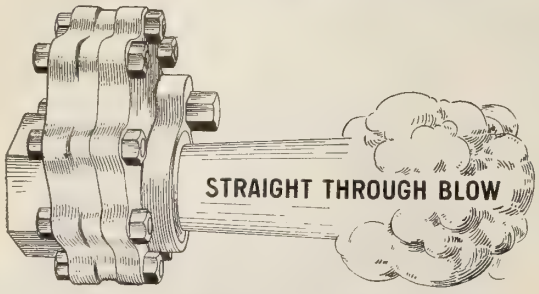
It is made by experts from plies of selected duck. Absolutely guaranteed.

Ask us for further information and prices.

Dominion Belting Co., Ltd.,

HAMILTON, CANADA

EVERLASTING
BLOW-OFF VALVES



IT NEVER LEAKS!
WRITE FOR PRICES

200,000 IN USE

Does your Boiler leak, Mr. Engineer?
How often do you blow it?
The "EVERLASTING" is the only perfect blow off valve on the market.
No stuffing box—requires no packing—is self-cleaning, and has a self-grinding seat—nothing to get out of order—What's the answer?

RELIABILITY—SIMPLICITY.

SOLD AND MANUFACTURED UNDER CANADIAN PATENTS BY

Engineering Specialties Company, 1080 King St., West, TORONTO
LIMITED

AGENTS

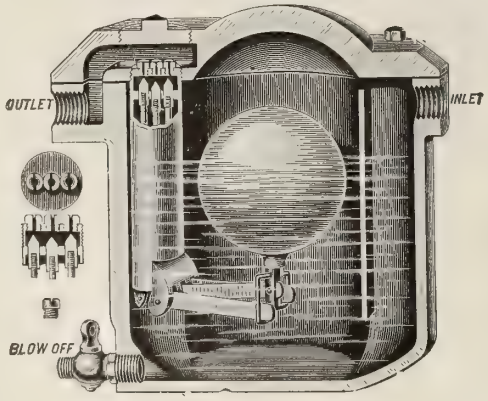
MONTREAL, QUE.
H. L. Peiler & Co.

ST. JOHN, N.B.
The A. R. Williams Mach. Co.

WINNIPEG, MAN.
The A. R. Williams Mach. Co.

CALGARY, ALTA.
P. D. McLaren Limited

VANCOUVER, B.C.
Taylor-Forbes Company, Limited



Wright
"Emergency" High Pressure Continual Flow Steam Trap

THREE VALVES

GREAT CAPACITY

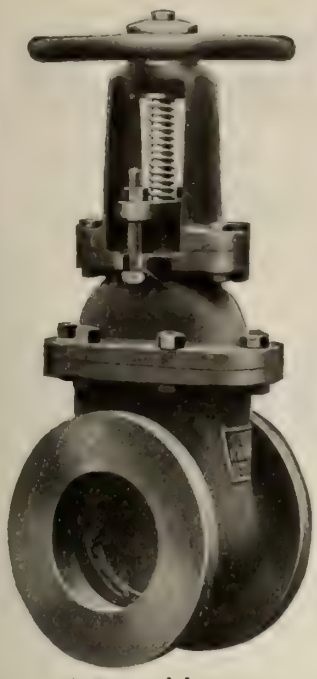
Keeps the steam line automatically and continually drained of accumulating condensation.
Shipped subject to trial and return if results are not satisfactory.
Send for Catalog.

DARLING BROS., Limited
15 Ottawa Street, MONTREAL

TORONTO WINNIPEG ST. JOHN, N.B.

The advertiser would like to know where you saw his advertisement—tell him.

KERR GATE VALVES



4½-in. and larger

OUTSIDE SCREW AND YOKE

"KEYSTONE" PATTERN

Embody all the latest features

Screwed in Seats

Deep Bronze Bushed Gland and Stuffing Boxes.

Full Opening.

Large Diameter Hand-Wheels.

Solid Wedge Discs.

4-in. and smaller

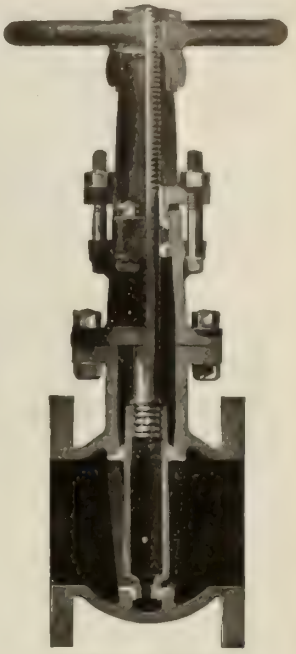
Narrow face-to-face Dimensions

Symmetrical Design.

Good Material.

Interchangeable Parts.

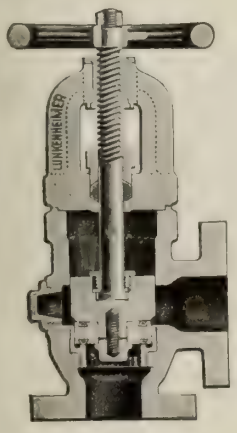
Guaranteed Tested.



4½-in and larger

The Kerr Engine Co., Limited, MANUFACTURERS

Walkerville, Ontario



LUNKENHEIMER "DURO" BLOW-OFF VALVES

are guaranteed for 250 pounds working pressure. The body is made of cast iron, having a tensile strength of 25,000 pounds per square inch, and the bronze used contains a large percentage of copper and tin.

One of the principal advantages in the design of these valves lies in the construction of the **seat and disc**, which **provides self-cleansing seating surfaces**, so that any scale or grit lodging on the face of the seat will positively be washed off before the disc is firmly seated, thereby **insuring a perfectly tight valve.**

The **disc** is **double faced**, and can be **reversed** or **renewed** when worn. The seat is renewable, as are also all other parts of the valve subjected to wear. **Lunkenheimer "Duro" Blow-off Valves** are made in sizes ranging from 1¼-inch to 3 inches inclusive.

Specify and insist upon securing genuine **Lunkenheimer make.** Do not accept substitutes,—they are never as good as the genuine.

"MOST supply houses sell them, yours CAN, if they DONT or WONT, tell US."

Write for Catalogue.

THE LUNKENHEIMER COMPANY

Largest Manufacturers of High Grade Engineering Specialties in the World.

General Offices and Works: CINCINNATI, OHIO, U. S. A.

16-43

New York, 64-68 Fulton St.

Chicago, 186 N. Dearborn St.

Boston, 138 High St.

London, S. E., 35 Great Dover St.

"THERE is a principle which is a bar against all progress, which is proof against all argument and cannot fail to keep a man in everlasting ignorance. This principle is unreasoning prejudice against full investigation."

WHY NOT INVESTIGATE THE

FULTON WATER-COOLED MECHANICAL STOKER

OTHERS HAVE DONE SO AND HENCE

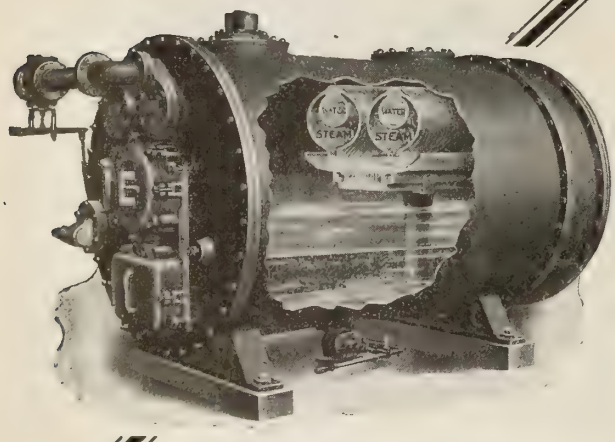
4,000 HORSE-POWER SOLD

AND INSTALLED IN CANADA IN 1913

Manufactured by

The HARE ENGINEERING COMPANY, Ltd.

14-16 King Street East **TORONTO**



EFFICIENCY

is the ratio of what is, to what ought to be—it ought to be a

NATIONAL

FEED WATER HEATER

then you can talk about efficiency

NATIONAL Direct Contact Feed Water Heater

is the only feed water heater in which all of the steam and all of the water must come into *direct and actual contact*, thereby insuring the highest possible temperature.

It's a heater, purifier, filter, storage tank, oil separator—all in one. It heats by bringing the water and exhaust steam into actual contact. It has upward filtration, which insures longer life to the filter material.

ASK FOR CATALOGUE NO. 2

The National Pipe Bending Company

91 Lloyd Street, New Haven, Conn.

Makers of Pipe Coils and Bends of Every Description—for all Purposes—Iron, Brass, Copper 46-44

The advertiser would like to know where you saw his advertisement—tell him.

MURPHY FURNACES

OCCASIONALLY we fail to get first contract; WHEN GET FIRST CONTRACT it is in but RARE INSTANCES WHEN DO NOT GET REPEAT ORDER—when additions are made to plant.

Illustrative of this: THE ST. LAWRENCE STARCH CO., Limited, Port Credit, Ont., bought Murphy Furnaces as follows:

1st order	March 1908	3 furnaces, 645 h.p.
2nd "	Feb. 1910	1 furnace, 215 h.p.
3rd "	June 1913	4 furnaces, 600 h.p.
3 contracts—in 5 years:		8 furnaces, 1460 h.p.

REPEAT ORDERS are the best evidence of merit!

For printed matter address:

MURPHY IRON WORKS, DETROIT, MICH. BUFFALO, N. Y.

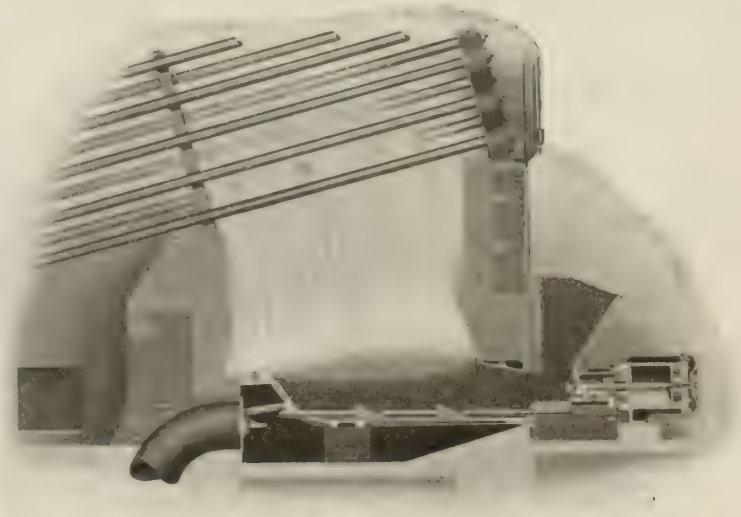
28 TIMES

They asked for more JONES STOKERS

In January, 1904, the Standard Oil Company placed their first order for

JONES STOKERS

In December, 1912, they placed their 29th order—covering a total equipment for 35,236 boiler H.P.



Why did the Standard Oil Co. repeat 28 times on Jones Stokers?

Why did the C.P.R. repeat 11 times for plants in Montreal, West Toronto, Winnipeg and Victoria?

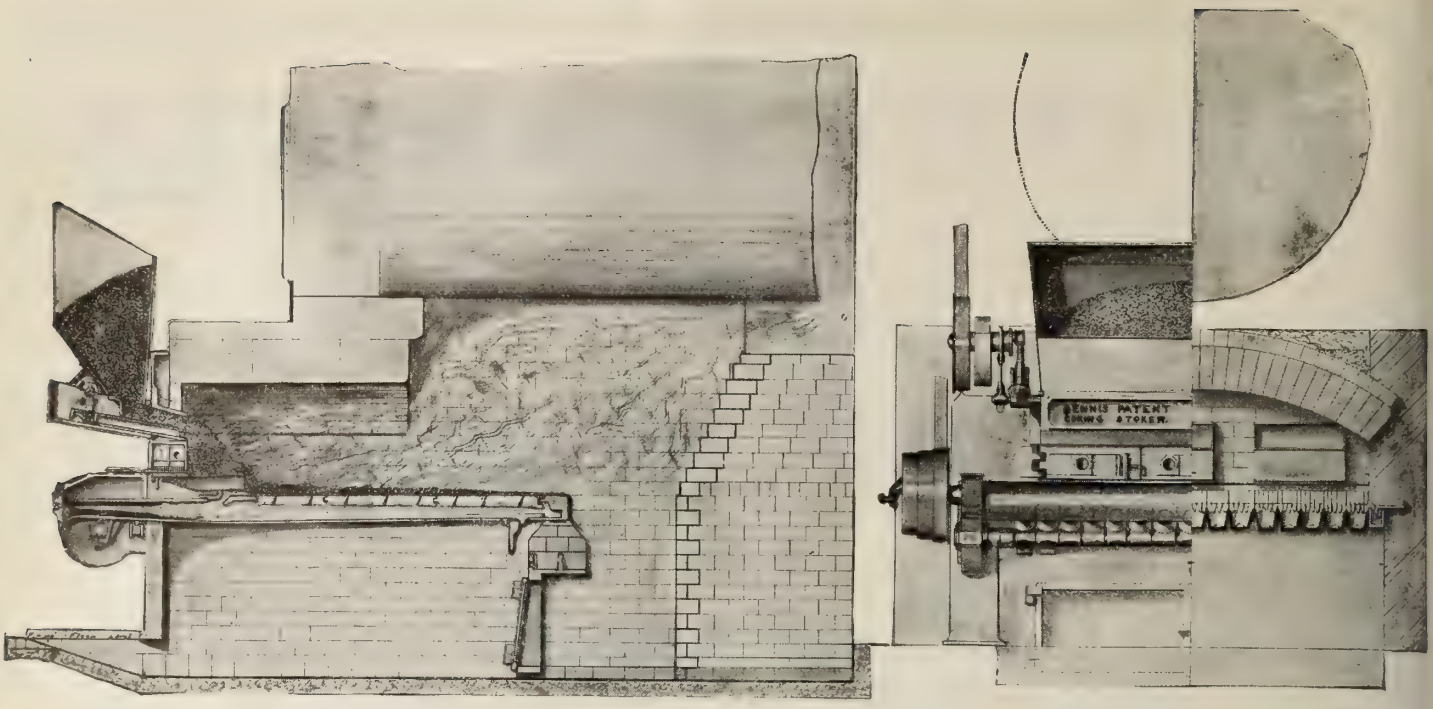
Why did the E. B. Eddy Company repeat 8 times and the Halifax Electric Tramway Company 5 times?

Why, out of the last 60 orders for Jones Stokers, 47.1 per cent. were repeat orders?

The answer is in the stoker—efficiency and low repairs—the simplest mechanical stoker built. Has fewer parts, none of them exposed to action of fire. Simple and sure in operation—a labor saver, a fuel saver, a money maker in any plant, large or small.

JONES UNDERFEED STOKER CO., LIMITED

National Trust Building **Toronto, Ontario**



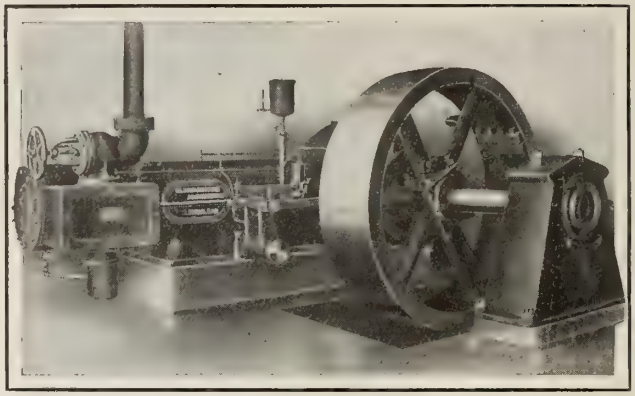
LONGITUDINAL SECTION FRONT VIEW

ARRANGEMENT OF BENNIS COKING STOKER APPLIED TO HORIZONTAL RETURN TUBE BOILER

MILLIONS OF DOLLARS are SAVED YEARLY by the USE of BENNIS MACHINE STOKERS

WRITE FOR A FULL SET OF "BOILER HOUSE ECONOMY AND CHEAP STEAM" PAMPHLETS TO

G. H. TOD, 213 Manning Chambers Queen Street West **TORONTO**



Side Crank Leonard Automatic Engines

Particularly adapted for Direct Dynamo Connection and Electric Light Service. Made in Simple and Compound Units up to 500 Horse Power. For High Economy and Close Regulation this engine is unexcelled.

We also make High and Slow Speed Corliss Engines for Heavy Duty Service. Our "Tangye" Engine is very well and favorably known throughout Canada for Sawmill Work.

MADE BY

E. LEONARD & SONS, LONDON, ONTARIO

MANUFACTURERS OF

High and Slow Speed Engines of all kinds, Boilers, Heaters, Pumps, etc., etc., and complete Steam Plants.

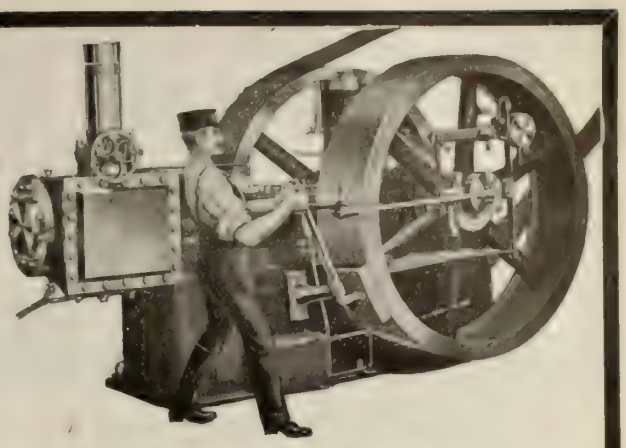
WAREHOUSES AND AGENCIES AT

MONTREAL, ST. JOHN, N. B., CALGARY, WINNIPEG, VANCOUVER

The advertiser would like to know where you saw his advertisement—tell him.

Do You Know That Your Engine Has a Brake on it?

You wouldn't put a brake on your engine's fly wheel. You would more likely re-babbit the bearings, lubricate it, and see that it is in proper alignment. Then why have a concealed brake in every one of your stuffing boxes?



J-M SEA RINGS

are put into the stuffing box with a clearance between them and the rod—they push against the rod only when there is an outward pressure, and then only in proportion to that pressure. The steam or other fluid gets behind the LIP and does the work.

They are automatic, hence economical. Our Blue Book "Facts and Figures" describes J-M Sea Rings and their working principle.

Write our nearest Branch for a copy.

THE CANADIAN H. W. JOHNS-MANVILLE CO., Limited

Manufacturers of Asbestos and Magnesia Products — TRADE ASBESTOS MARK — Asbestos Roofings, Packings, Electrical Supplies, Etc.

TORONTO MONTREAL WINNIPEG VANCOUVER

1746

A Wonderful New Gauge Glass

The Test

"Resisto" and other Gauge Glasses were tested against hot pressure when suddenly brought into contact with cold water, with the following results:

French Tubes broke at 90 lbs.
Scotch Tubes broke at 105 lbs.
Compound Tubes broke at 225 lbs.
Durax Tubes broke at 405 lbs.
RESISTO Tubes broke at 465 lbs.

AFTER much extensive experimenting the makers of the famous Durax and Compound Gauge Glasses have placed on the market the RESISTO GAUGE GLASS—a glass well named and one meeting with immense approval.
This wonderful new glass embodies the features and qualities of the two above named glasses and really excels in each. Subjected to the most rigid tests, the RESISTO glass was found to be far superior to all others in every requisite of an ideal Gauge Glass, which are: resistibility against pressure, temperature changes and the corrosive attacks of steam, distilled water and boiler compound. The grand, final test quoted above is convincing as to the resistive properties of the RESISTO GAUGE GLASS.

Send for pamphlet and sample of RESISTO GLASS now if you want to eliminate gauge glass troubles forever.

The Schaeffer & Budenberg Mfg. Co.

Brooklyn, N. Y.

Chicago
New Orleans
Atlanta
Pittsburgh
Washington

Every *genuine* RESISTO glass has a red line through its length and bears the diamond trade mark.

THE SCHAEFFER & BUDENBERG MFG. CO. RESISTO HIGH PRESSURE GAUGE GLASS

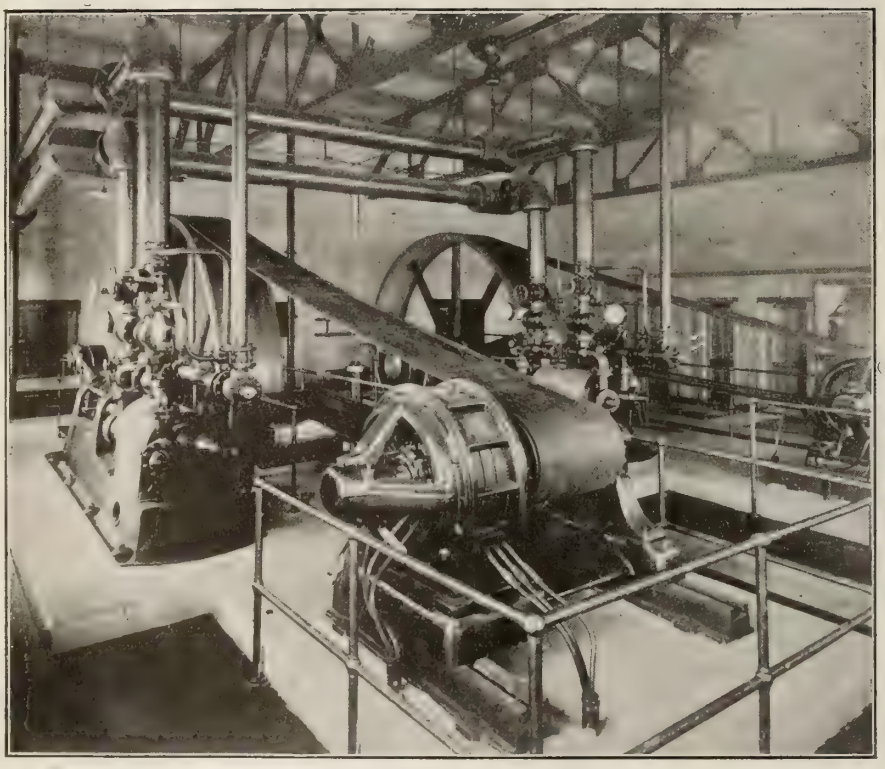
Send a postal NOW for pamphlet and sample of RESISTO GAUGE GLASS.

"THE LINDE"

REFRIGERATING and ICE-MAKING MACHINERY

CORK INSULATION

Over 8,000 Machines in use. Established and Manufacturing in Canada for 16 years.



Two 100-ton "Linde" Belt Drivers, Double Acting, Horizontal Ammonia Compressors Manufactured and Installed by us in Canada.

Recent Orders:—

IMPERIAL BREWING CO., (3 orders), Kamloops, B.C.
WM. CLARK, LTD., Montreal, Que.
MR. J. A. PATRICK, New Westminster, B.C.
C.P.R. VANCOUVER HOTEL, Vancouver, B.C.
MATTHEWS-LAING, LTD., Fort William, Ont.
CARSON'S HYGIENIC DAIRY CO., Winnipeg, Man.
ST. THOMAS PACKING CO., St. Thomas, Ont.
MONTREAL GENERAL HOSPITAL, Montreal, P.Q.
OTTAWA UNIVERSITY, Ottawa, Ont.
WM. DAVIES CO., Winnipeg, Man.
CANADIAN NATIONAL EXHIBITION, Toronto, Ont.
McGILL UNIVERSITY, Montreal, P.Q.
G.T.P. FORT GARRY HOTEL, Winnipeg, Man.
C.P.R. ALGONQUIN HOTEL, St. Andrews, N.B.
AND MANY OTHERS.

The Linde Canadian Refrigeration Co.,

Limited

37 ST. PETER STREET, MONTREAL

Branch Offices—Toronto, Imperial Building, Adelaide St.; Winnipeg, 909½ Main Street; Vancouver, Anderson & Miskin, Imperial Block, Seymour and Pender Streets; Edmonton, Walker & Barnes, 562 Second Street; Calgary, General Supplies Limited, 1233 2nd Street East.

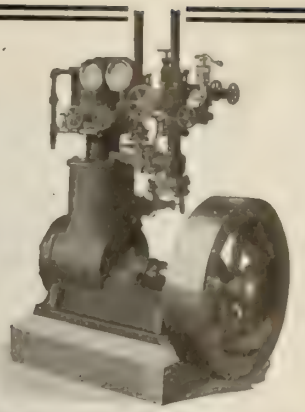
The advertiser would like to know where you saw his advertisement—tell him.

ESTABLISHED 1867.

THE VILTER MANUFACTURING CO.

242 BECHER ST., MILWAUKEE, WIS., U.S.A.

A small machine for small Ice-making and Refrigerating Plants, as well constructed and as successful in operation as larger outfits. VERTICAL SINGLE-ACTING AMMONIA COMPRESSORS, different sizes. Built with fewest possible number of parts. Sold at low price. Excels all others of like size in every point—simplicity, efficiency, reliability, smoothness of action, etc. We build horizontal and vertical ICE-MAKING AND REFRIGERATING MACHINERY, a full line of CORLISS ENGINES, and MACHINERY FOR BREWERS AND BOTTLERS. Our plant covers more than eight acres of ground.



Vertical Single-Acting Ammonia Compressor. Enclosed Type for Belt-drive.

The

LINDE BRITISH

Refrigeration Co. Limited

¶ Numerous fully authenticated laboratory tests organized from time to time in America and Europe, have invariably served to demonstrate in an unanswerable manner, the very remarkable degree of mechanical efficiency to which our products have been brought. ***The history of mechanical refrigeration is our history.***

Head Office: LONDON, ENG.

BIRMINGHAM	GLASGOW	JOHANNESBURG, S.A.
BRISTOL	BOMBAY	SYDNEY, N.S.W.
LIVERPOOL	CALCUTTA	PORT NAPIER, N.Z.

CANADIAN OFFICES
CORISTINE BLDG
MONTREAL

Self-Lubricating

In Cans
6, 12, 25 and 50 lbs.

SAFETY PLASTIC
METALLIC PACKING

LASTS FOR YEARS AND NEVER WEARS THE PISTON ROD.

Guaranteed to stand steam temperature up to 550 degrees Fahr.
Guaranteed to stand hydraulic pressure to 5,000 pounds per square inch.
Packing furnished in bulk and in thin Cotton Tubes, sizes 3-16 to 1½ inch, 36 inches long, or in special lengths to fit your stuffing boxes.
Empty Cotton Tubing in assorted sizes FREE OF CHARGE with orders for the packing in bulk form.
The tubes are easily filled and they save you the expense of carrying a large stock of packings in different sizes.

Send for FREE SAMPLE and particulars.

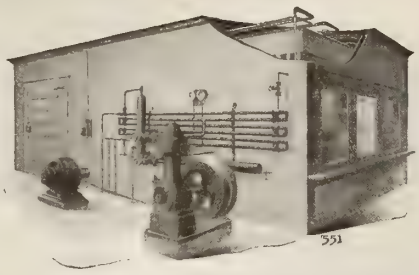
Manufactured only by

STEEL MILL PACKING CO. WINDSOR, ONT.

Practically Frictionless

Sold on APPROVAL

Warm Weather—More Ice!



One-half to 17 Tons Refrigerating Capacity

Economize by installing a YORK Refrigerating Plant. More sanitary — eliminates re-icing — produces uniform dry temperatures.

We make a specialty of equipping Markets with Refrigerating Machines and Apparatus. Our Enclosed Machine, when used in connection with a properly proportioned congealing tank evaporating system, will maintain the required temperatures in the cooler when operating not over ten to twelve hours per day.

These Machines need but little attention and do not require a skilled Operator.

Write for catalog.

YORK MANUFACTURING COMPANY

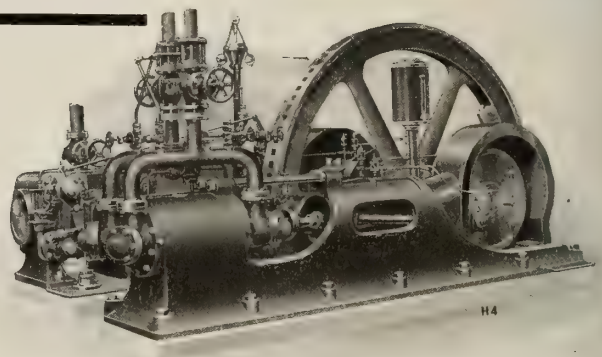
Main Office and Works: YORK, Pa., U.S.A.

Represented in the Dominion by

CANADIAN ICE MACHINE COMPANY

TORONTO, 163-167 Yonge Street **WINNIPEG, P.O. Box 336**

FRICK



Refrigerating and Ice-Making Machinery and Equipment

is acknowledged the world over to have attained the highest degree of efficiency. For thirty-three years FRICK Machines have successfully endured the wear of exhaustive tests and proven all guarantees made.

It will pay YOU to KNOW US.

The FRICK is the only machine of which it can be said "There is no better machine built." The FRICK is durable—efficient and will last a lifetime.

We build all types of Refrigerating Machines—Vertical Single-acting, Horizontal Double-acting and Absorption.

WRITE FOR CATALOGUE TO

FRICK COMPANY, - Waynesboro, Pa., U.S.A.

NEW YORK CHICAGO SEATTLE PITTSBURGH CLEVELAND LOS ANGELES
ST. LOUIS DALLAS ATLANTA BALTIMORE BOSTON

The advertiser would like to know where you saw his advertisement—tell him.

J. V. Jamison, President. T. B. South, Vice-President. J. V. Jamison, Jr., Treasurer.

THIS IS A CONTRACT

Looks Fair to Us. It is Fair

We invite users of Refrigerator Doors and Windows who are contemplating erection or remodeling plants to write us for

Sample Door and Frame Complete

We will forward it to size required. If it is not satisfactory from every standpoint to **you** in style, workmanship, efficiency and plan, it is your property without charge or any obligation to us whatever. We feel justified in making the above offer, to show our foreign friends our good faith. We have no Agents, either here or in your great country, to exhibit and present our products. In this proposition we hope to prove that we merit your confidence.

Our patronage in Canada is very large and general. A few of the largest sales are to:—

Linde Canadian Refrig. Co.	Montreal, Can.
P. Burns & Co.	Calgary, Alta.
Swift Canadian Co.	Toronto, Ont.
Whyte Packing Co.	Brockville, Can.
Moose Jaw Cold Storage Co.	Moose Jaw, Sask.
Standard Milk Co.	Vancouver, B.C.
Edmonton City Dairy Co.	Edmonton, Alta.
Canadian Fish & C. S. Co.	Prince Rupert, B.C.

Jones Cold Store Door Co.

HAGERSTOWN, MD. U. S. A.

Arctic Electrically Driven

Ice plants are producing pure, crystal ice in cans, at a decreased cost for power and labor, and making a finer quality ice than the distilled water product.

This result is accomplished by installing our

Raw Water Ice Making Equipment

using the Arctic-Pownall System.

Any cheap motive power, such as water power, oil or gas engine, or electricity may be used.

Full particulars and printed matter will be mailed you — simply write us saying you are interested.

"We do it Right."

THE ARCTIC ICE MACHINE CO.

CANTON, OHIO, U.S.A.

Ice and Refrigerating Machines

THE COMING AMMONIA COMPRESSOR

THE "SAFETY"

Built by

The HUETTEMAN & CRAMER CO.

DETROIT, MICH.

Complete Ice Making and Refrigerating Plants for every conceivable purpose.

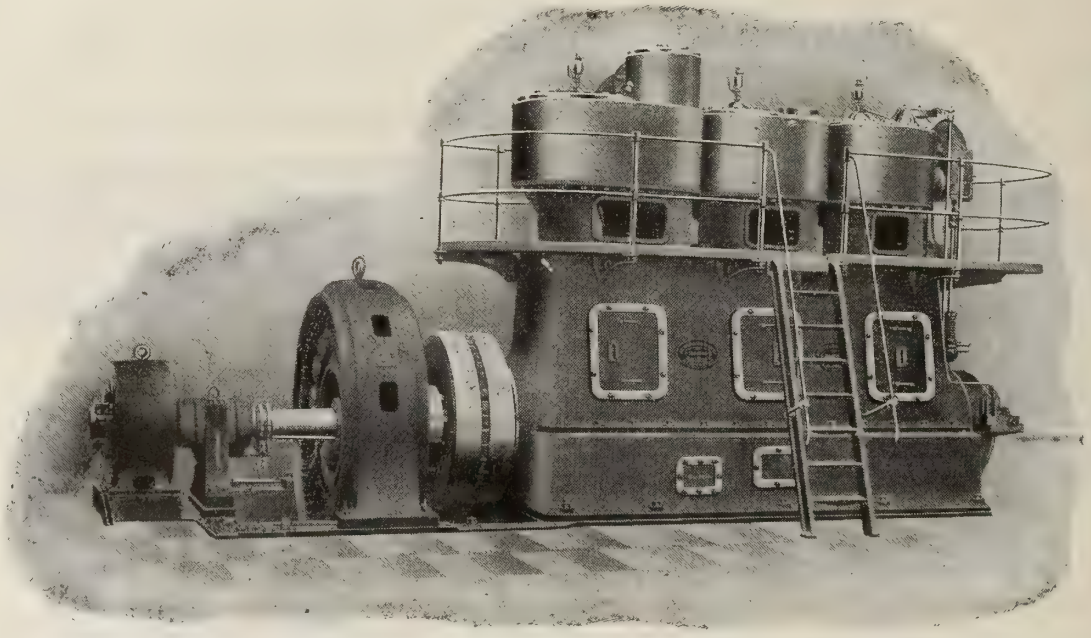
SIX OF THESE "SAFETY" INSTALLATIONS TO DATE IN ONTARIO THIS SEASON

The "Browett-Lindley"

Quick Revolution, Forced Lubrication, Double Acting Steam Engines

Simple ***Efficient*** ***Economical***

These engines have established a high reputation in electric light and tramway plants, collieries, cotton and paper mills, steel and iron works, etc., and are made in five different styles to suit steam pressure and working conditions.



Three-crank, Triple Expansion, "Browett-Lindley" Engine driving 500 K.W. Generator.

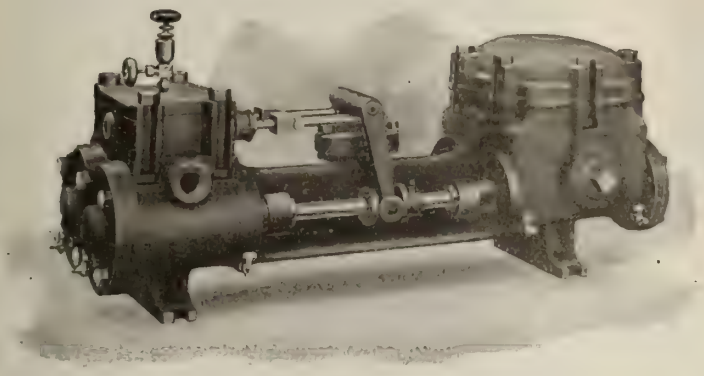
Sole Agents for Canada:

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., Limited

Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

Works: Seigneurs & Williams Streets, MONTREAL.

POWER HOUSE PLANT



Boiler Feed Pumps

Our new Duplex Steam Boiler Feed Pumps have been designed with the idea of making them more compact and accessible than any pumps hitherto offered for this service.

These new standard pumps can be furnished in sizes to give any quantity of water desired up to 2,000 U.S. gallons per minute against a working pressure of 150 lbs. per square inch, with a steam pressure of approximately 100 lbs. per square inch.

Barrow Boiler

The Barrow Combination Fire and Water Tube Boiler made by us embodies three essentials —abundant steam and water space, perfect circulation, and perfect combustion.

SEND FOR DESCRIPTIVE PAMPHLET

CANADIAN ALLIS-CHALMERS, LIMITED

Head Office:—KING AND SIMCOE STREETS, TORONTO

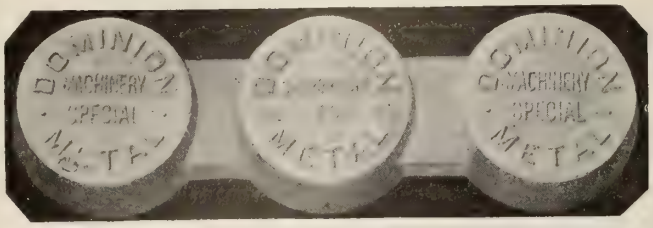
DISTRICT SALES OFFICES:—

Montreal Halifax Ottawa Cobalt Porcupine Fort William Winnipeg Regina Saskatoon Calgary Edmonton Nelson Vancouver Victoria Prince Rupert

Mr. Manufacturer

What Service do you get?

Our Babbitts (designed by N. B. Prichard, Chemical and Mining Engineer with over 20 years experience) will meet your every need.



We study your Babbitt Needs as you study your manufacturing Processes—RESULT—the best babbitts for your requirements at PRICES, which will surprise you.

Every pound guaranteed to be made good, or no charge.

Four Favorite Brands:

PRICHARD'S EAGLE GENUINE
PRICHARD'S MACHINERY SPECIAL
(Copper Toughened)
PRICHARD'S METALLIC PACKING
PRICHARD'S MAPLE LEAF

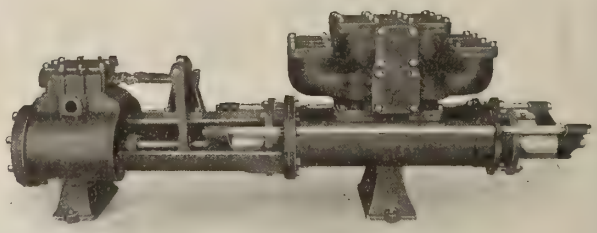
All correspondence promptly answered.

The DOMINION METAL COMPANY

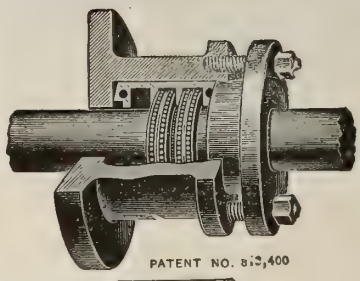
Babbitt Specialists
SHERBROOKE, P. Q.

Montreal Selling Agents
Foss & Hill Machinery Co., 344 St. James Street, Montreal

STEAM and POWER PUMPS, CONDENSERS, TRAVELLING CRANES



The SMART-TURNER MACHINE CO., Limited
Hamilton Canada



PATENT NO. 813,400

PAT. NO. 436,177
" " 500,899
" " 524,104
" " 602,328

PAT. NO. 654,541
" " 654,542
" " 725,368

Why not Buy the Best, when in market for Packing?

HOLMES'
Metallic Packing
is Guaranteed 3 years

Lasts many times longer. 30 days trial. Less oil. No cutting. Easily applied to any Steam Engine, Air Compressor or Gas Engine. Satisfaction or no pay. Write us.

Holmes Metallic Packing Co., Wilkes-Barre, Pa.

Marsh Steam Pump

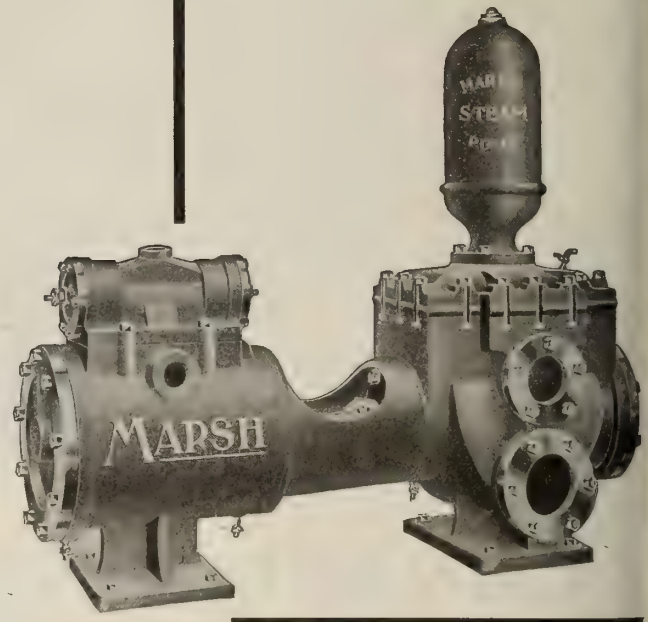
The Pump with the Self-governing Steam Valve

Note the extreme simplicity in construction and the absence of outside valve motion. There is practically nothing to get out of order. Nearly all the wearing parts are made of phosphor bronze instead of common brass, including piston rod, water cylinder lining and valve seats.

The steam valve is self-governing and admits only just enough steam to do the required work. The pump cannot short-stroke, race or pound under the most severe conditions.

115,000 in successful operation.

Ask for Catalog No. 18



American Steam Pump Company
BATTLE CREEK, MICH.

CANADIAN AGENTS

A. R. Williams Machinery Co., Toronto
Williams & Wilson, Montreal
London Engines Supplies Co., London, Ont.
Stuart Machinery Co., Winnipeg
Hallman Machinery Co , Vancouver, B. C.
Mechanics' Supply Co., Quebec, Que.
Gorman, Clancey & Grindley, Limited
Edmonton & Calgary

THE TRIPLEX BLOCK

The Best Practice in Power Plants

THE new book of Hoists shows modern boiler room installation for handling coal by electric hoist and trolley. Under 4,000 lb. loads these hoists travel 350 feet per minute from bunkers to furnace, controlled from the floor or from a trailer cage.

Both for the Power Plant or Marine Engineer this book shows the latest application of chain blocks and trolleys to enable one man to lift, move and adjust any load up to 20,000 pounds.

Write for a copy of this book to-day. It will result in decreased costs in handling.

Safety of Steel

The Triplex Block is steel construction—steel in all load bearing parts, sheave, gears, pinion, hooks and chain.

EACH BLOCK TESTED TO 50 PER CENT. OVERLOAD

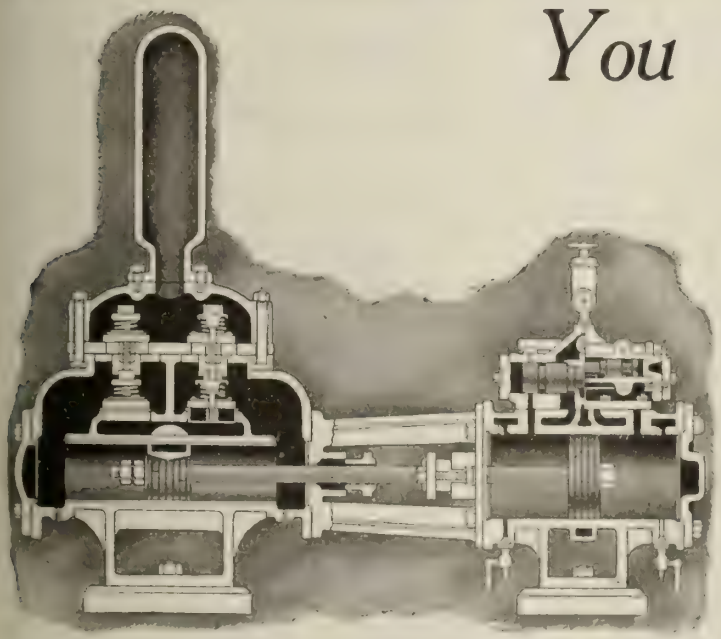
Yale Products—Locks, Padlocks, Builders' Hardware, Door Checks and Chain Hoists.

Also Duplex Blocks, Differential Blocks and Electric Hoists

The Canadian Fairbanks-Morse Company, Limited

Montreal St. John Ottawa Toronto Winnipeg
Saskatoon Calgary Vancouver Victoria

You Can Not Equal It For Simplicity



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No Packing in Steam End
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All Faces Machined

¶ "Bawden" Pumps are governed by piston valves which are controlled by the action of live steam only.
Simplicity throughout.
Greatest economy of steam consumption.
Valves, latest improved steam balanced type.
Guaranteed to make full stroke under constant or varying loads.

¶ The "Bawden" Pump provides the simplest, most economical and reliable means for feeding high or low pressure boilers.
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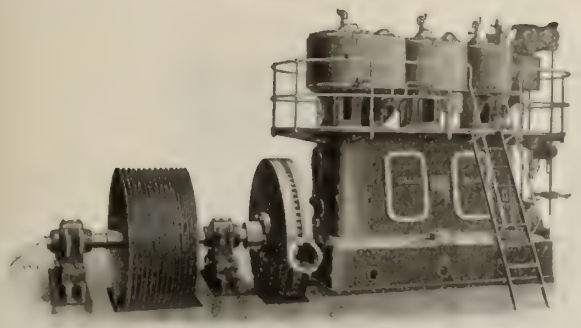

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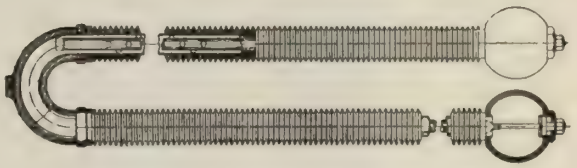

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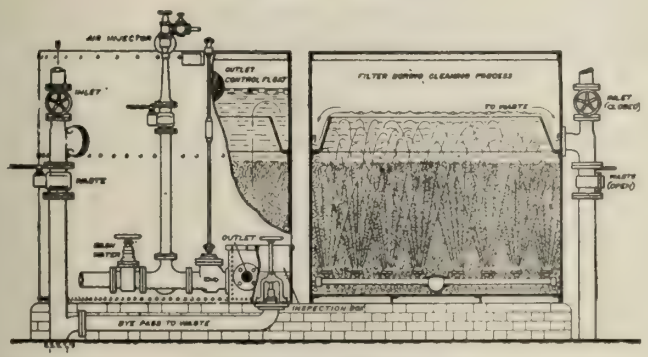

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An Example of our Achievements in Power Plant Equipment—

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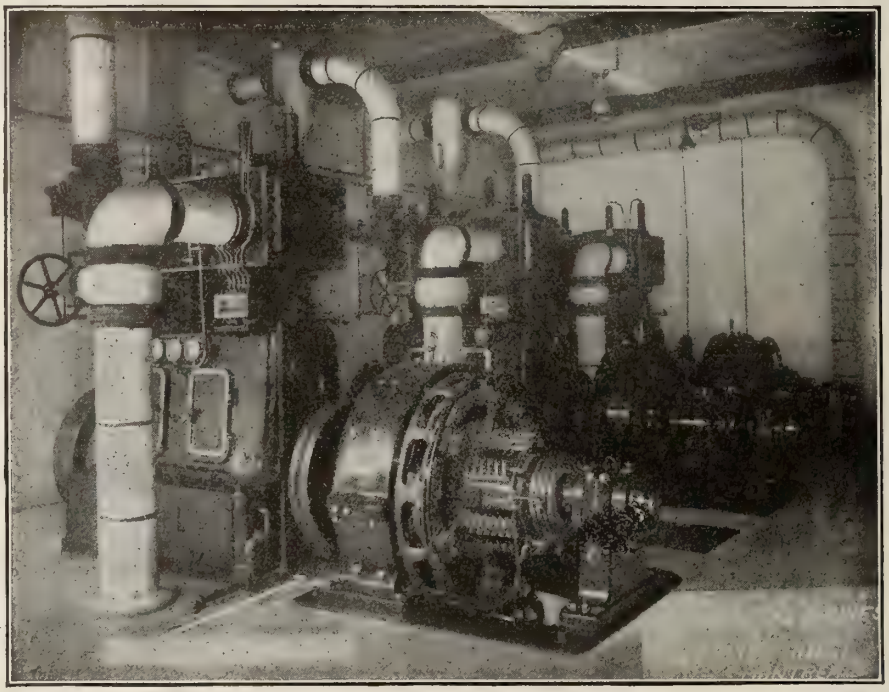

THE POWER PLANT OF THIS HOTEL INCLUDES

THREE ROBB WATER TUBE BOILERS each 200 horse power, and THREE ROBB COMPOUND ENGINES each driving a 150 K.W. Generator.

ROBB COMPOUND ENGINES

¶ These engines are short-stroke, high-speed, completely-enclosed, automatically-governed, and every revolving and sliding surface lubricated by oil under pressure.

Essentially of the marine type, many of the features are well adapted to stationary practice, especially for driving generators, turbine pumps, fans, etc.

Ask for Bulletin 201

WATER TUBE BOILER

¶ Cross drums and a patented connection between front header and drum give unrestricted circulation.

The rear header, hung by vertical pipes for flexibility, also forms the mud chamber.

Horizontal tubes connecting the two drums at the water line complete the circuit for water, and the curved tubes at the top conduct to the rear drum the dry steam separated out in the front drum.

Ask for Bulletin No. 6

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Manufacturers of ROBB ENGINES, BOILERS, ETC.

WORKS: Amherst, N.S., South Framingham, Mass.

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39-50

The Seed Drill and The Reaper

¶ It is an amusing, and at the same time significant fact, that men who criticize and condemn advertising the hardest are the men who advertise the least.

¶ And the most violent critic of the lot is the man who doesn't advertise at all.

¶ These men put up strange arguments against advertising sometimes, and one of their pet diversions is to compare advertising with Personal Salesmanship.

¶ To compare Advertising with Personal Salesmanship is to compare the Seed Drill with the Reaper.

¶ They are separate and distinct. Each performs different functions, yet each is necessary for the common good.

¶ They work together, in the same field, for the same man, to the same end.

¶ Advertising is the Seed Drill of Modern Commerce.

¶ It plants the Seed of Good Will in the minds of prospective customers. The seed grows to interest, and interest turns gradually into a desire to possess. The harvest ripens and is garnered in by the ever-ready salesman.

¶ The Salesman is the Reaper of Modern Commerce.

¶ He reaps where advertising has sown.

¶ Advertising performs the missionary, the educational and the preliminary work—The Salesman comes along and with minimum exertion carries away the order, and, frequently, all the glory of securing it.

¶ He reaps most who sows the best, and a just man will not forget the seed drill when the reaper is at work.

Rate Card and Full Information Gladly Furnished on Request.

THE POWER HOUSE

A Monthly Publication Devoted to the Generation, Transmission, and Application of Steam, Gas, Electric Air and Water Power.

143 University Avenue TORONTO

G. & McC. VERTICAL QUICK REVOLUTION STEAM ENGINES

Will give you as they are giving others wherever installed

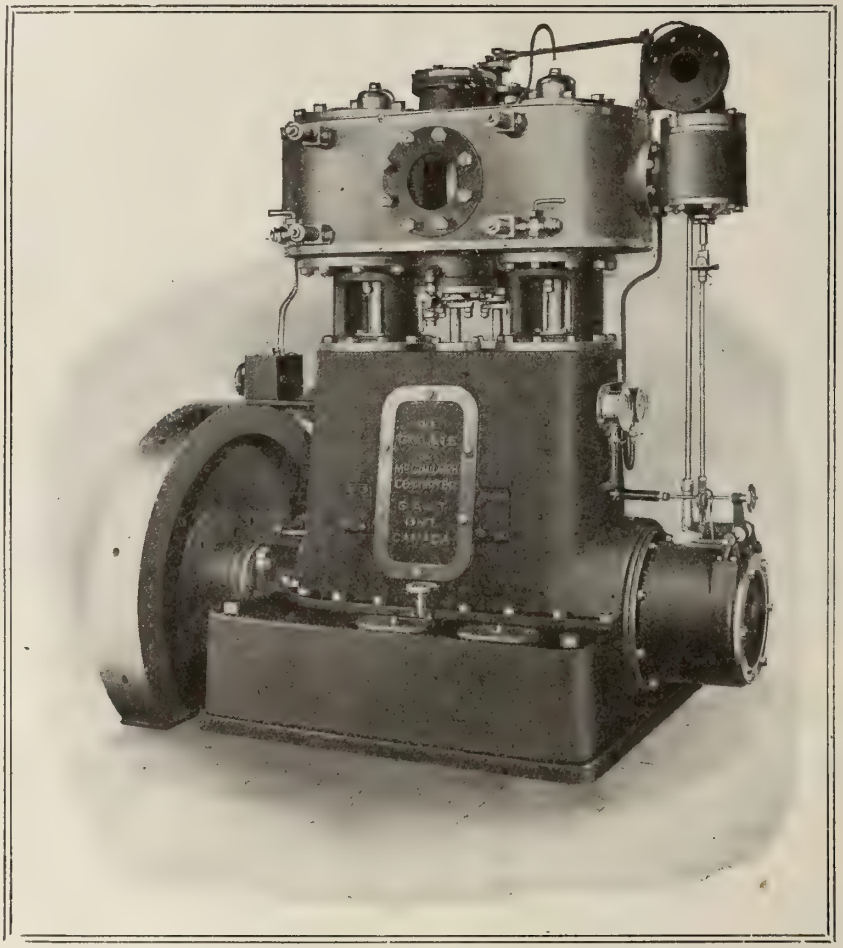
A MAXIMUM OF SERVICE

At a Minimum Cost of Upkeep

These Engines have a Perfect System of forced Lubrication.

They require little or no attention while running.

Built in all types and sizes.



They run with Practically no Noise or Vibration.

All working parts are very easy of Access.

Built to suit your Particular Requirements.

Two Cylinder Compound, Vertical Forced Lubrication, Quick Revolution Steam Engine, with Combined Throttle and Expansion Governor.

All the materials used in the Manufacture of Vertical, Quick Revolution Engines must be the best obtainable. In the construction of our Engines particular attention has been paid to this feature; the materials supplied being in accordance with **British Admiralty Specifications.** All Engines are tested under steam before leaving our works.

We shall be pleased to furnish Specifications and further information.

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Outline Sketch of Power Plant, City of Wetaskiwin, Alta.

By J. S. Watson *

The details and illustrations of the above power plant, give a fair indication of the progressive and up-to-date spirit pervading the citizens of our Western towns and cities . The utilities of light, heat and power are being recognized as mighty influences in popularity, developing and bringing under civilization, the vast territorial expanse of our Dominion.

THE new steam power plant of the city of Wetaskiwin, Alta., was completed some few months ago, and, with a view to readers of The Power House getting a glimpse of the equipment installed, the accompanying data and illustrations are presented. The old plant, with the exception of the producer room, is also included in the detail description.

*Power Plant Superintendent.

Fig. 1 shows a Bellis & Morcom vertical high speed engine, 360 revs., 430 b.h.p., coupled direct to a Swedish General Electric Co. generator of 375 K.V.A., 2,200 volts, 2 phase, 60 cycle, with direct connected exciter.

Fig. 2 shows the switchboard supplied by Swedish General Electric Co., and consisting of 1 feeder, 1 power and 2 arc panels. The room seen underneath is the distribution room, in which are placed two oil automatic circuit breakers, one for the East and one for the West side of city. The generator rheostat is placed in this room, being operated by a chain from the switchboard. Two 20 k.w. transformers are also installed here for building, lighting and power house power purposes.

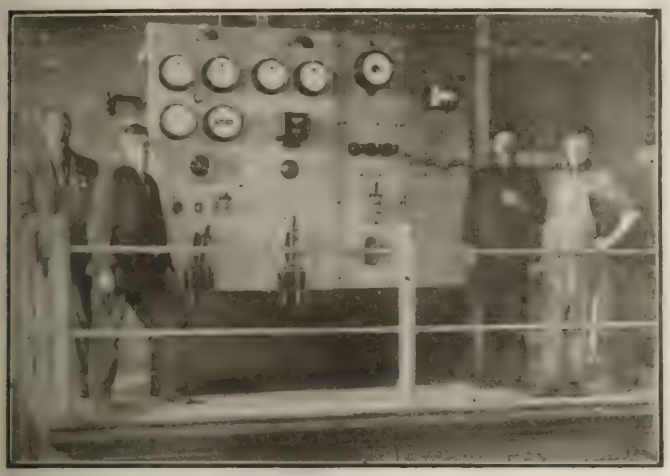


FIG. 2. SWITCHBOARD.

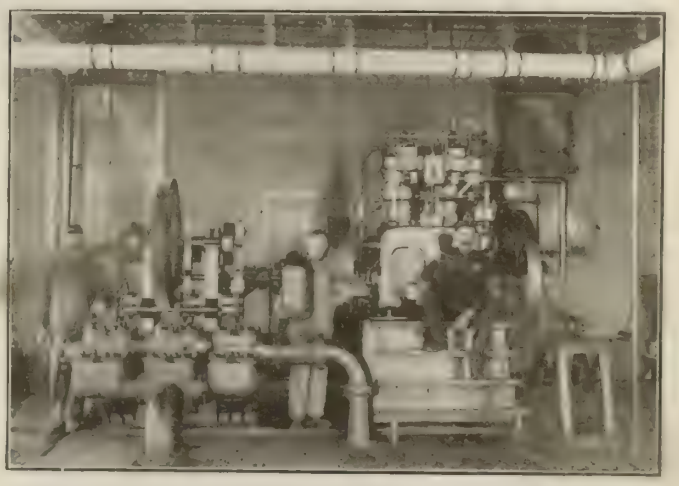


FIG. 3. 500 G.P.M. 3 PISTON, DOUBLE ACTING TYPE PUMP.

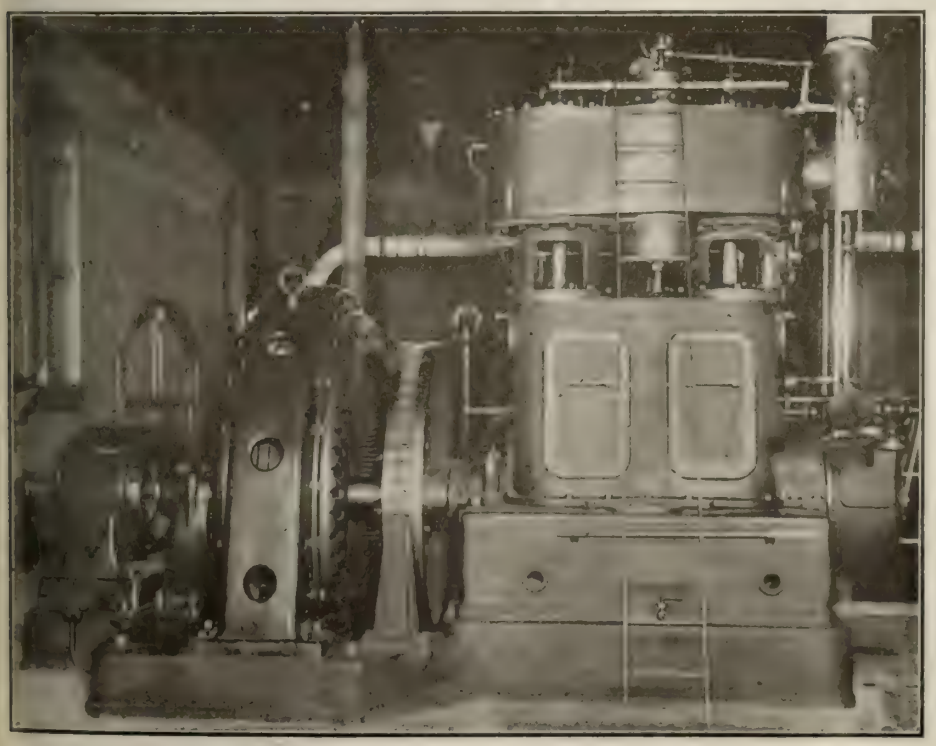


FIG. 1. BELLISS & MORCOM VERTICAL HIGH SPEED ENGINE.

Old Plant.

Fig. 3 shows a 500 gallon per minute pump of the 3 piston, double acting type, by F. Pearne & Co., Holyoke, Mass., which is driven by a 40 h.p., 2-cylinder Westinghouse gas engine. This pump delivers water into a standpipe of 180,000 gallons' capacity, against a head of 160 ft. vert.

New Power Station.

Fig. 4 shows the new power station building, south and west sides, while Fig. 5 shows the B. & M. engine described in Fig. 1, and the John McDougall Co., Montreal, tandem compound, duplex type, fire pump. The latter is used either for domestic supply or fire purposes.

In the rear of this picture will be noted the 2-stage, cross compound steam driven air compressor, built by the Ingersoll-Rand Co., of New York. Its capacity is 500 cub. ft. of free air per min. at 110 lbs. per sq. in. pressure. This compressor is used for pumping from wells 250 ft. deep on the air lift system. The water is delivered into a concrete reservoir of 220,000 gallons capacity beside the power house.

FIG. 4. SOUTH AND WEST SIDES OF NEW POWER STATION.

Fig. 6 shows the air pipe lines for the air lift system, with the receiver and connections leading through wall to the wells, three in number. There is also shown in the right hand corner, one of the boiler feed pumps supplied by the John McDougall Co. It is of the Blake, duplex, outside packed, pot valve type with brass-lined rams. This pump takes its water from the reservoir and passes it through a National feed water heater supplied by Waterous Engine Co., Brantford, Ont. The heater will be observed in a corner of the boiler room.

The exhaust steam from the various units goes through this heater as will be noted by the 14 in. exhaust header passing along the wall. A condenser for this plant is out of the question in the meantime, as water is too expensive to raise, besides there is a possibility in the near future of getting natural gas for fuel. Drilling operations are going on at present. We are waiting the result of the gas well proposition before considering the condenser feature.

Fig. 7 shows our battery of 3 return tubular boilers, with heater in right hand corner. The boilers and piping were supplied by the Waterous Engine Co. the former consisting of two 150 h.p., and one 100 h.p. units. The main steam header from the boilers, and from which branches lead to the various units is 10 inches diameter.

Other units of the original plant, in addition to those already referred to, consisted of a Westinghouse 3-cylinder gas engine of 160 h.p., and a 120 h.p. Robb-Armstrong tandem compound steam engine, both of which, previous to the extensions and additions, had become too light for our load. Up-to-date wash and toilet equipment is installed for the comfort and convenience of the plant staff.

Kilmer, Pullen & Burnham, Toronto, and Laurie & Lamb, Montreal, are Canadian representatives of the Swedish General Electric Co., and Belliss & Morcom, Ltd., respectively.

E. F. Bradley has been appointed manager of the Toronto office of the International Engineering Works, Ltd.

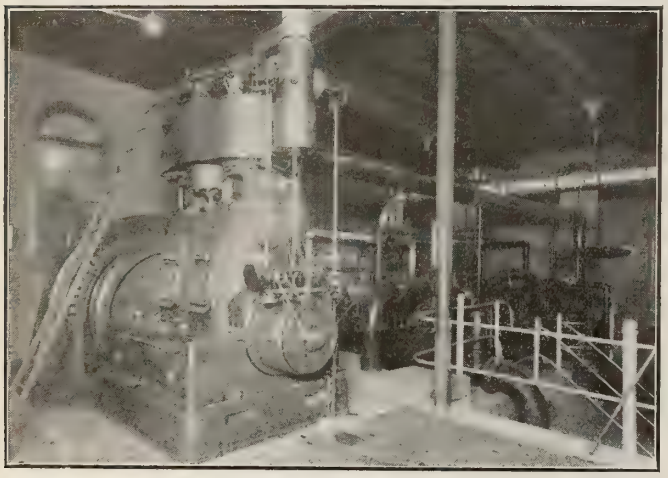


FIG. 5. B. & M. ENGINE AND TANDEM COMPOUND DUPLEX TYPE FIRE PUMP.

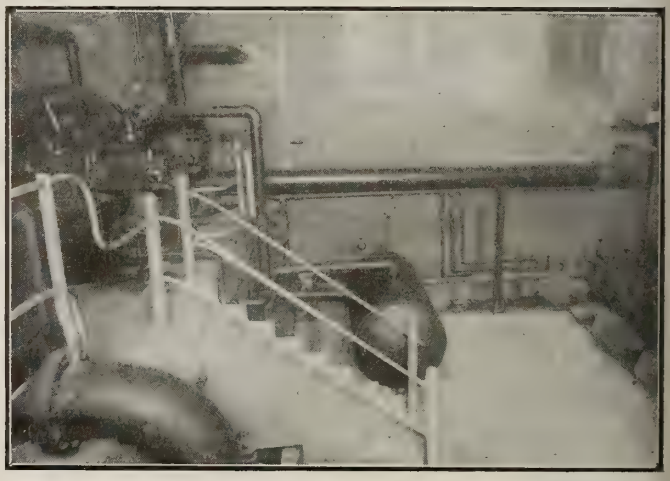


FIG. 6. AIR PIPE LINES FOR AIR LIFT SYSTEM.

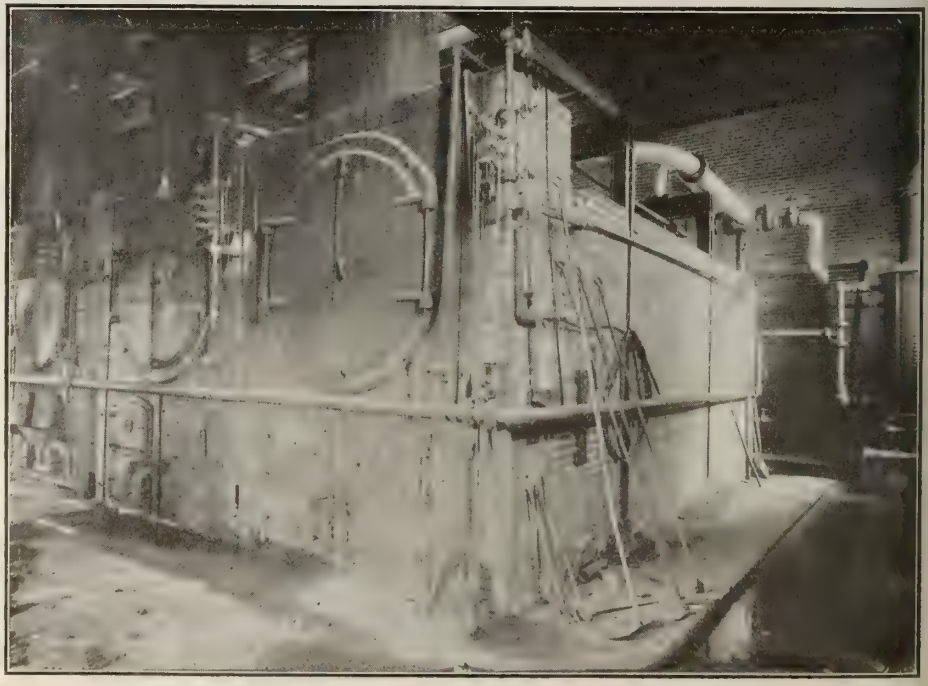


FIG. 7. BATTERY OF 3 RETURN TUBULAR BOILERS.

VALUE OF SIMPLE ADJUSTMENTS.

IN a letter to the Editor of "Vulcan," Mr. Wm. Cozens, Vulcan Co., Inspector, Edinburgh, Scotland, says:—

It is surprising the time that must be lost to owners of electrical machinery, especially in shops where one or two motors only are installed, through want of just the little knowledge they should have in regard to the running of their machines. Some say a little knowledge is a dangerous thing, but as the following instances will show, used in the right way, this knowledge would have saved the owners a great deal of time and expense.

Fuse Blown Out.

In one instance, complaint was made that a motor driving a circular saw was not working satisfactorily, and on making an examination it was found that one of the fuses had blown. After fitting in a new fuse, the motor was set to work again. This motor had not been newly installed, but had been in the place for several years. The loss to the owner must have been considerable, as the motor had been standing two days, before the complaint was received. The above may be rather an exceptional case, but the other two are not far behind it.

Worn Carbon Brush.

A second instance necessitated the inspector travelling a long distance to examine a motor that was reported to have broken down. This motor was used for driving sewing machines in a shirt factory, and had been standing for one day, causing about twenty girls to be idle, a thing that should not have happened, if someone in that factory had just shown some interest in the motors, and acquired just that little knowledge to have put this particular motor right in five minutes, but too frequently I find that motors are put down in a place, and as long as someone pours oil into the bearings now and again, the motor gets leave to run till some very simple thing happens, and then it is a case of "wire" for the inspector, and probably hours lost, in some cases days, and very often someone's temper as well, when all this could have been saved if a man had been told off to keep the motor clean and attend to it generally. All that was wrong in this case was, one of the carbon brushes had got so badly worn that it was too short to reach the commutator, with the result that the motor stopped.

Starting Switch Trouble.

The third case I come across frequently, is also very simple. Complaints are made that the motor very often stops, and in some cases the starting-switch will not stay on the running position. I had a case of this just the other day. Notice was received that the starting switch would not stay on, and the motor was idle through this. On examination, it was found that the cut-out arm on the overload coil had come into action, and instead of dropping down again it had stuck up, consequently preventing the switch arm from staying on the running position. This was put right in about ten minutes, by filing a small piece off the tops of the contacts, the switch was quite new, and the contacts were found to be just a shade too long causing the cut out arm to wedge between the contacts.

My object in pointing out the neglect of simple matters such as referred to, is that by paying attention to little adjustments, much time and money would be saved both the owners, and insurance companies.

PROBE B. C. WATER POWER DISPUTE.

FOR the purpose of consulting with the British Columbia Government in regard to water powers in the railway belt, J. B. Challies, superintendent of the Dominion Water Powers Branch, and S. J. Robins, assistant private secretary to the Minister of the Interior, left Ottawa recently for the coast.

It has not yet been clearly defined as to the ownership of certain water powers there. Both the Federal and the Provincial Governments claim ownership, and a discussion has been going on for some time, more particularly as to whether the Dominion or the Provincial Governments have jurisdiction over the Hudson Hope Power Co. A report will be submitted to the Minister of the Interior on the return of his officials.

New Bank of Toronto.—In our leading article on the Light, Heat & Power Equipment of the New Bank of Toronto, mention was made of the building having been designed by the firm of Carrere & Hastings, New York, associated with Eustace G. Bird, Toronto. We are advised by the latter gentleman that the design was of his origination, that the various drawings were made in Toronto, that the work of construction was carried out under his supervision, and that the New York Office simply examined the plans and made a number of minor suggestions.

Qu'Appelle, Sask.—The Fort Qu'Appelle Sanitarium is being equipped with a 6-ton refrigerating machine, contract for which, including entire high pressure side and direct expansion piping for storage rooms, was let to the York Manufacturing Co., York, Pa.

MONTREAL AND TORONTO PUBLIC UTILITIES.

SOME interesting figures have been compiled in regard to the number of public companies in Montreal which contribute to the civic exchequer compared with the number of companies, etc., in Toronto.

There are fifteen of such companies in Toronto compared with eleven in Montreal. The figures in both instances show just what assessed values are levied on the companies for buildings, land, plant in streets, rails and poles. In some cases the business tax is also included in Toronto, but in Montreal it is not shown in the total assessments as the method of levying the business tax in the latter city is not given under the heading of assessment on property.

Toronto Companies.

The following table shows just what companies were taxed in Toronto last year and the total amount of assessed values in each case:—

Name of Company.	Total Assessment.
Street Railway Co.	$2,886,665
Consumers' Gas Co..	4,109,690
Toronto El. Light Co..	1,947,918
Bell Tele. Co.	1,663,869
C.P.R. Telegraph Co.	121,042
G.N.W. Telegraph Co.....	76,220
Grand Trunk Railway	5,000,283
Toronto & York Radial Co..	90,632
Toronto & Suburban Co.. ..	31,400
Interurban Electric Co.	13,746
Toronto & Western Ry. Co..	2,900
Erindale Power Co....	505
Can. North & Ontario Ry...	199,116
Can. Pac. & Ontario Ry.....	3,913,693
Toronto & Niagara Pow. Co.	389,797

Montreal Companies.

In Montreal the public companies and the assessed values are shown as follows:—

Name of Company.	Total Assessment.
Montreal Tramways Co.....$	4,301,155
Grand Trunk Railway	6,994,100
C.P.R., Ontario & Quebec Ry.	12,388,855
Lachine, Jacques Cartier & Maisonneuve Ry.	103,900
Light, Heat & Power Co....	3,757,750
Canadian Light & Power Co.	172,400
Saraguay Electric Co..	107,300
Shawinigan Water & Power Co..	42,500
Montreal Water & Power Co.	1,689,800
Bell Telephone Co..	2,256,650

It will be noted that while there are fewer public utility companies in Montreal than in Toronto, the last assessments of most of them are far larger than is the case in the latter city.

Power Plant Equipment of the Windsor Hotel, Montreal

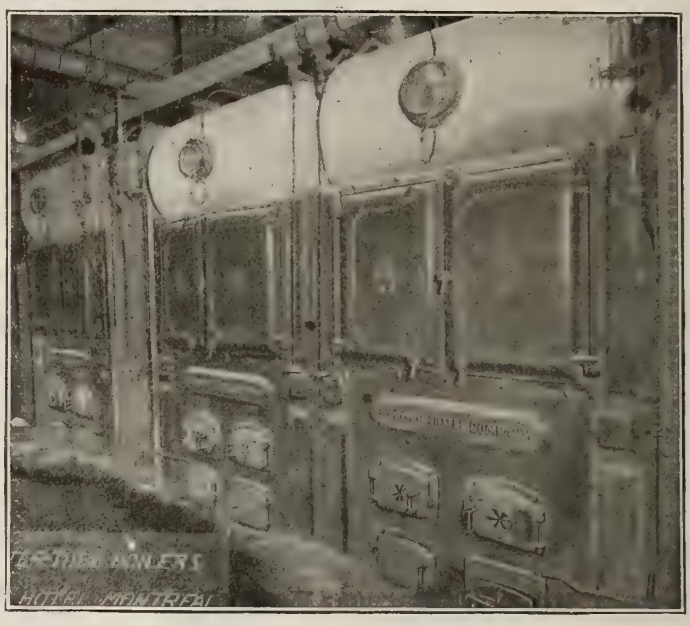
By C.T.R.

Continuity of service in the matter of light, heat and power is perhaps of more vital importance in a large and widely patronized hotel, than in almost any other business enterprise. It is not surprising, therefore, to find that the provision made to secure such a consummation in this particular instance, is both up-to-date and ample.

THE power equipment for the new Windsor Hotel, Montreal, designed and installed under the supervision of R. S. Kelsch, consulting engineer, of that city is more complete than usual because of the problems to be met. The power plant, which is in charge of Mr. Winkworth, chief engineer of the Windsor Hotel Co., is among the most up-to-date isolated power plants in Canada. The main object of the power plant is to furnish light and heat to the hotel, and power for the various motors used in the laundry, for ventilating fans, etc.

Boiler Equipment.

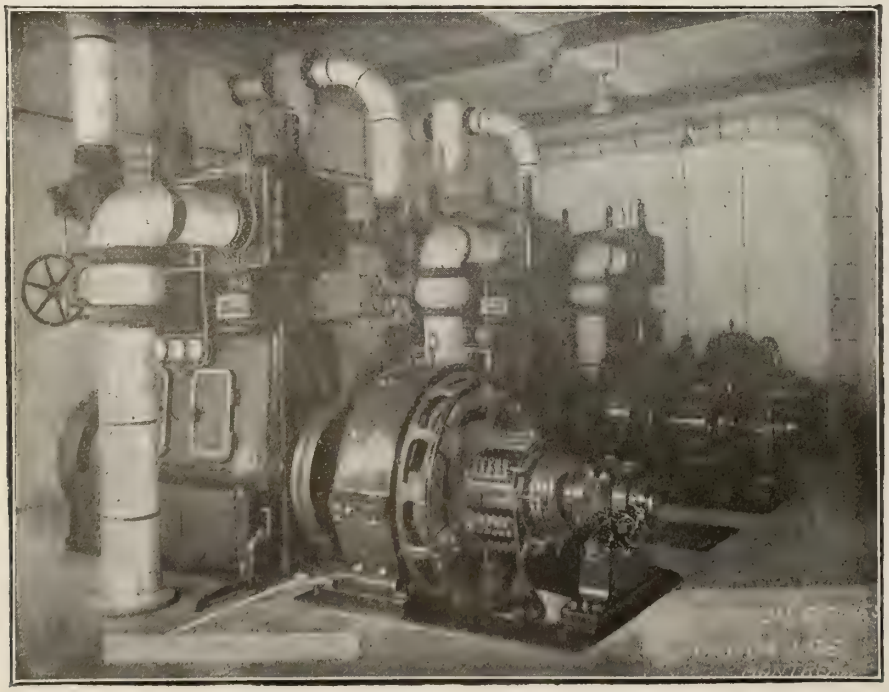
The steam generating equipment consists of three 200 h.p. Robb water tube boilers, each with a heating surface of 2,143 square feet. Two of the boilers are set in a battery and one is installed singly. The boilers, which are built for 175 pounds working pressure, are equipped with Cotton blowers for burning anthracite screenings. This type of boiler consists of two horizontal cross drums with headers which are connected by a main bank of inclined tubes. The drums are connected by two rows of horizontal tubes which complete the path of circulation for the water. At the extreme top, superheating tubes connect the drums so that the steam which is separated in the front drum is thoroughly dried and slightly superheated when it enters the rear drum from which it is piped to the engines.



BOILER BATTERIES, WINDSOR HOTEL.

These boilers have a large throat area where the front header joins the front drum, giving a free and unrestricted passage for the large volume of water and steam passing from the main bank of inclined tubes into the drum. As the drums extend crosswise, and the headers are as wide as the length of the drum, there is no contraction at the throat as becomes necessary in some types where longitudinal drums are used.

Great flexibility is another feature of this new boiler not only from the way it is placed in the setting on the supporting framework, but also because of the construction of the boiler itself. All the tube surfaces run in one direction, and the plate surfaces in another, thus eliminating the strains caused in boilers where the longitudinal drums, headers, and tubes are connected rigidly together. Of thoroughly modern design, this boiler has ample provision for cleaning, a handhole being placed in the header opposite each tube.



ENGINE EQUIPMEN T, WINDSOR HOTEL.

Engine Room Equipment.

In the engine room of this power plant there are installed three Robb vertical compound engines which run non-condensing. Each engine is direct-connected to a 150 k.w. electric generator made by the Canadian Westinghouse Co. These engines operate the generators at 25 per cent. overload for two hours and 50 per cent. overload for one hour. With steam at 150 pounds pressure, they carry the normal load at a speed of 425 r.p.m. Being entirely enclosed, the working parts are protected

from accident, and there is no danger of oil being thrown about the engine room. Every revolving and sliding part is automatically lubricated by a system which consists of a pump and distributing pipes in which a pressure of from 10 to 20 pounds per square inch is maintained. The engines have many features which have been very succesful in marine practice, and, modified for stationary practice, enable them to maintain the speed desired for direct connection.

Electric Equipment.

The electric equipment had to take into account the fact that for some few years the hotel is under contract with the Montreal Light, Heat & Power Co. for current, so that electrical machinery will be used only as a stand-by during this period. This situation called for especial skill in design because the Power Co. operates with alternating current generators which means that the direct current switches of the hotel must remain open except in the event of a shut down on the part of the Power Co. Should this happen, the engines in the new power house will be started, the bus bars made alive therefrom, and the circuit breakers and the switches on the feeders closed. Signal lamps indicate when the alternating current switches are closed, and the direct current switches are open. These signals enable the station operator to properly manipulate the switches so that the entire lighting system of the hotel will be transferred from the dead alternating current bus to the working direct current.

Laundry Equipment.

Electrical equipment for the laundry is interesting in that the individual drive is used throughout, and in addition the body ironers are electrically heated and all hand ironing is done electrically. The washing machines and extractors have individual motors, those for the washing machines being directly geared, while the others are belted, both being controlled from a master switchboard located in the engine room adjacent to the main switchboard. The circuit breakers and controllers are so arranged that the washing machine attendant simply presses the starting button, the machine making two revolutions in each direction until stopped by the pressing of the stop button.

The stopping and starting of the extractors is also accomplished by the push button method but in this case the attendant must keep the starting push button pressed until the extractor has attained almost full speed. This arrangement is necessary because of the possibility of the basket being out of balance, therefore, the attendant cannot leave or neglect the machine. He must stand by and observe what is happening until everything is safe.

Ventilation.

The ventilation of the laundry is well taken care of by two 30-inch ventilating fans with variable speed motors located in a pent house at the top of a shaft extending from the ceiling of the first floor through the second. Registers are connected to the shaft on the second floor, but go through the third and fourth floors without further opening.

Economies in the Installation of Electric Power

By W. E. Milne

The question of the most suitable power with which to operate our factories and workshops is one of large interest to those responsible for their management and in no less degree, does it concern the power plant operator. Expressions of opinion from those particularly interested in any phase of the subject are therefore necessarily instructive and valuable.

THE author acknowledges at the outset that the electric motor is not suitable for every class of work. There were, indeed, many instances in which its use might be advisable from an engineering point of view, but wherein it could not prove a commercial success. Technical knowledge and practical experience were essential to determine these cases. He was strongly of opinion that the commercial canvasser who, lacking any technical knowledge, possesses those qualities of salesmanship which enable him to get motors into consumer's premises, is a dangerous person to employ. Such a person, he said, is not able to discriminate between those jobs which are suitable and those which are ill adapted for the electric drive. Again, a number of the installations secured by him, even if not altogether unsatisfactory, are to a great extent spoilt through lack of engineering arrangement.

Technical Advice Necessary.

The author strongly emphasised the importance of technical advice in arranging an electric drive. He said that electric motors are too often installed on the advice of commercial assistants, or others possessing little or no electrical knowledge, and the results are lamentable, a shunt motor being recommended in all circumstances and for all purposes.

Considering the many types of electric motors and the great variety of control gear, he said, it is a pity that the shunt motor with an ordinary starting switch is apparently used on every possible occasion. A commercial engineer with technical knowledge should find no difficulty in inducing a reasonably-minded consumer to obtain, at slightly greater expense the type of motor or control gear which will give the maximum efficiency and the greatest convenience, and which will not only cover his requirements, but will also give many advantages not found in the usual installation.

Technical knowledge is also essential in handling alternating-current work. Unfortunately, in many cases, the engineers handling power installations display a lack of knowledge of the various forms of electrical apparatus which may be brought to the notice of manufacturers. The blame for the majority of unsuccessful installations of electric power should, however, rest on the shoulders of mechanical engineers rather than on electrical engineers.

The author thought that in considering the matter of economies, far too much importance is generally attached by power users to the actual cost of power, and it was also difficult to get a manufacturer to realise the many considerations which are put forward when comparing estimates for the cost of driving.

We are all familiar, he said, with the gas engineer's somewhat crude method of comparison between gas and electric driving. The power user is usually told that, say, a 10-h.p. gas engine takes 20 cubic feet of gas per horse-power-hour. On a 50-hours per week basis this works out at 10,000 cub. ft. of gas, which if charged at 36 cents per 1,000 cub. ft., equals $3.60. On the other hand, the customer is told that a 10-h.p. motor consumes approximately one unit per horse-power-hour, which is equivalent to 500 units per week. Taking current at 2 cents per unit, he is thus shown that the electric motor would cost $10 against $3.60 for a gas engine.

Having commented upon the unreliability of such comparisons, the author suggested that a method of estimating the cost of driving based on figures actually obtained from existing manufacturers' installations gives a commonsense and accurate comparison. Such a method, he contended, is practical, and the figures can be backed by the evidence and results obtained from several years' working on various drives.

Load Curve Comparison.

Another method of comparison which appeals to a manufacturer with an ele-

mentary knowledge of engineering, is to obtain load curves for the steam engines by means of continuous recorders, or from electric motors by means of recording ammeters, and to submit such curves to a power user.

The owner of a mill, which was steam driven, assured the author that the large number of rolls on his engine resulted in a practically steady load, so that the engine was worked at a very high efficiency throughout its run. He argued that under such conditions electricity could not compete with steam engines on the ground of cost. A continuous indicating diagram, however, showed that his load varied from 70 to 215 h.p., and a glance at the curve on the diagram secured, would convince any engineer that on such a load, the maximum efficiency cannot be obtained by steam driving.

Electrical Factory Labor.

In the concluding portion of his paper, the author presented an argument which he said unfortunately was not generally accorded the consideration it merited. This was that the conditions of labor and employment in electrically equipped factories are usually far superior to those found in works utilising any other form of power.

"It has been considered necessary for the well-being of labor," said Mr. Milne, "to enforce certain laws governing the lighting, ventilation, heating, and cleanliness of workshops and factories. It is safe to say that if electric power were universally used, and if no steam or gas were found in factories, these laws would rarely have been necessary. Practically in no case is steam or gas called in to improve the lighting, cleanliness, or ventilation of works. The introduction of electric power invariably gives better working conditions, and although these arguments may be somewhat advanced, there is no doubt they should be taken into consideration when considering the equipment of works and factories."

From a paper read before the Birmingham local section of the Institution of Electrical Engineers.

THE WORLD'S COAL SUPPLY.

THE coal resources of the world are dealt with by the Geological Congress in three volumes of 1,360 pages in all, illustrated by upwards of 175 maps and figures, and accompanied by a 68-page atlas of geological colored maps. A digest of the work was last week read before the delegates in session.

The coal production of Canada at the present time is only in the neighborhood of twelve million tons annually, and though the output may be expected to increase rapidly, actual exhaustion of the supply lies very far in the future.

Total Reserve of Coal.

The total reserves of the world, compiled from all the reports received, amount to 7,397,533 million tons, of which nearly 4,000,000 millions are bituminous coals, nearly 3,000,000 millions are brown coals of various grades, and nearly 500,000 millions are anthracite coals. Of the anthracite coals, Asia, with the great Chinese fields, has by far the largest supply of any of the great continental divisions, furnishing 407,637 million tons; in bituminous coals, America with 271,080 million tons leads by a great margin, as she does also in the various grades of brown coals.

World's Production of Coal.

The world's production of coal for the year 1910 was about 1,145 million tons, so that, though much must be allowed for loss in mining and for areas that for various reasons cannot be economically mined, there still remains many hundreds of years before exhaustion of the supply may be looked for. Taking up the individual countries, however, it is found that in more than one case the end is in sight.

SHUMAN'S SUN-POWER ENGINE.

IN a previous issue, attention was drawn to a sun-power pumping plant installed in Egypt.

The principle of this invention of Mr. Shuman's latest system of power-production, says a writer in the Daily Telegraph, is simple, the heat of the sun being used to raise steam in a specially constructed boiler, which steam drives a low-pressure engine. There is a series of generators, each consisting of a flat sheet-iron box, 3 ft. square, with plates only 1/8 in. apart, and covered by two sheets of glass an inch apart. The boxes are massed together over a space of 5,000 square feet, and have a heat-collecting area of about 10,300 square feet. The boxes are placed on trestles, and can be set at angles to suit the sun, whilst mirrors are used to direct additional sunlight on to the boilers.

The steam pipes from the various boxes are connected together, so that they discharge into a large pipe, 8 in. diameter, which conveys the steam to the engine. The latter is a low-pressure machine, designed specially to reduce heat losses to a minimum. It is provided with a tubular surface type condenser, which type is essential, as only distilled water can be used practically in the generators.

SUPERHEATING STEAM.

IT is well known that steam can be superheated by the heat released during pressure reduction, but it is generally considered that such a method is extravagant, though interchange of heat in the same way occurs to some extent in ordinary working in consequence of wire drawing or throttling.

According to the Railway News, an arrangement including this feature has been designed for locomotive engines. Steam is superheated in passing through a valve placed in a casing alongside the steam dome, and in the path of the steam from the dome to the smoke-box, this valve being regulated to maintain a predetermined constant reduction of pressure. The valve comprises a series of pistons of graduated diameters and controlled by an adjustable spring. After passing this valve, the steam enters a smoke-box superheater consisting of a series of tubes connecting with side headers, from which it may be assumed that the superheat obtained by pressure reduction is not a very valuable factor taken by itself.

To assist the smoke-box superheater, small tubes are placed in some of the boiler tubes, so as to conduct some of the furnace gases directly to a casing surrounding the superheater.

LENGTH OF LOCOMOTIVE BOILER TUBES.

WHILE no one argues that increasing the length of tubes adds to the steam generative capacity of the boiler in anything like corresponding proportion, there are few engineers, says a writer in the Railway News, who go so far as to claim that, beyond a certain length, the value is almost negligible. A record of experiments conducted at the Altoona testing plant of the Pennsylvania Railroad, recently made public, gives some interesting data concerning the matter.

The temperature observations indicate that the gases entering the tubes are of a lower temperature than is shown by a separate pyrometer placed in the middle of the fire-box. The fire-box temperature ranges from 2,000 to 2,400 degs., while the temperature at the tube ends is from 1,370 to 1,620 degs. They also show that there is a rapid decrease in temperature for a distance of 3 ft. or 4 ft. in the tube, after which the temperature drop is much more gradual, but even with short tubes only 13 ft. 8⅝ in. long, the temperature curve becomes flat towards the end of the tube, indicating that a large part of the heat is absorbed before half the length of the tube is reached.

Erratum.—The item under the heading Trade Gossip, page 244, this issue, in which Laurie & Lamb, are stated to have received the order for 3 Belliss & Morcom Engines from the Atlantic Sugar Refineries, St. John, N.B., is, we understand, incorrect.

Practical Data Relative to the Erection of Shafting

By Joseph Horner

Shafting for the transmission of power through belts, ropes ,gears, etc., forms a prominent feature of our factories and industrial plants generally. The necessity of giving its installation more than ordinary attention, and the points to be observed when doing so, are fully dealt with by the writer in the accompanying article.

THE present article is the second and concluding portion of the subject, the previous one published on July 10 covering the features of erection difficulties, weak shafts, influence of wear, shafting layout, erection methods, etc.

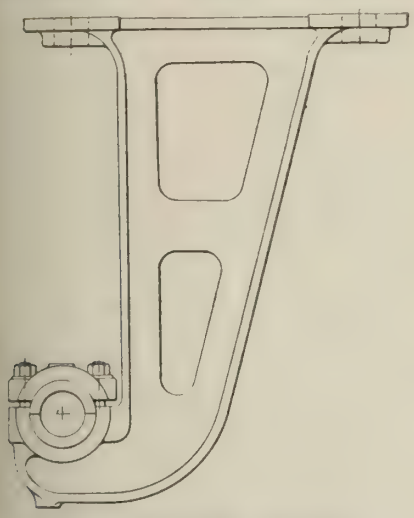


FIG. 12—HANGER BEARING.

Hanger Bearings.

The same methods of plumbing from centre lines laid down on the floor, described in the previous article, are adopted when, as is common, the hanger type of bearing, Figs. 12 and 13, is used bolted to the lower sides of beams. A similar templet is used for locating the center, and the position of the bolt holes, and similar packing pieces are used for adjusting the horizontal alignment of the bearings. A parallel straight-edge is laid along from bearing to bearing, and the height is tested and corrected with a spirit level. The shaft, when afterwards put in, is tested similarly, and also plumbed up from the centre line.

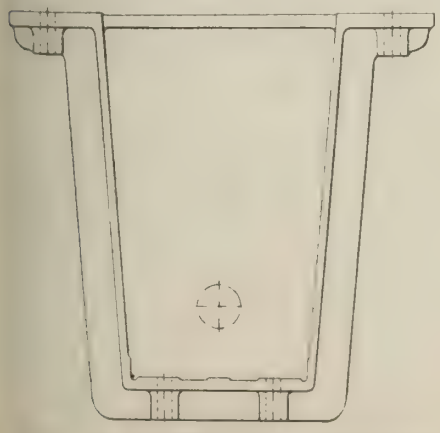


FIG. 13.—HANGER FOR SEPARATE PLUMMER BLOCK.

Swivel Bearings.

When swivel self-adjusting bearings, Fig. 14, are fitted, the same methods as the foregoing are gone through, but not quite the same amount of care is necessary in effecting the horizontal alignment, because the adjusting screws can be used for slight corrections for height, but only, however, to a small amount, in some types, within the range of the setting screws. The lateral adjustments must be exact, as the central

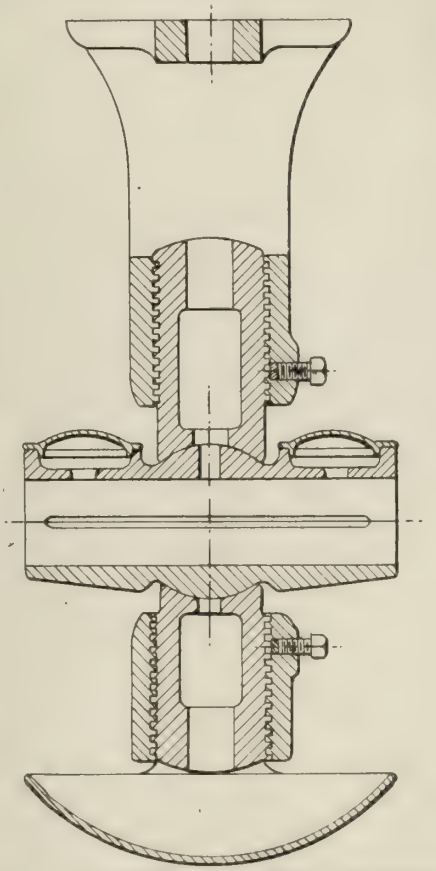


FIG. 14.—ADJUSTABLE SWIVEL BEARING

axis of the bearing is unalterable in that direction. When that is fixed, the swivel provides accommodation for unequal wear.

The Use of Targets.

An old method of erecting shafting, alternative to plumbing from lines on the floor, is by means of targets, or pieces of wood bolted to, and standing out from the joists adjacent to the bearings. This is convenient to adopt when the floor is crowded with machines. The two end bearings are first bolted up in place in positions corresponding with the ends of the shaft. There need be no difficulty in locating two end bearings. Then, as many targets are prepared as there are bearings to be fitted, and one is fixed on a beam adjacent to each bearing in any way convenient.

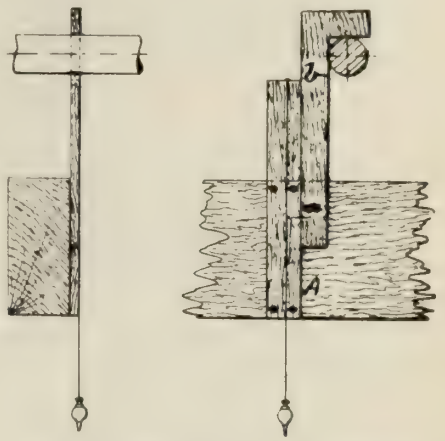


FIG. 15.—TEMPLET FOR PLUMMER BLOCKS.

They can be fitted to horizontal joists or to vertical columns. No hard and fast method need be adopted, but details will vary. Three variations are shown.

Fig. 15 is suitable for plummer blocks bolted on top of a beam; Fig. 16 for a hang down bearing, and Fig. 17 for a wall type of bearing bolted to a column. The point is that one edge (A) is vertical, a datum edge, from which lateral settings can be made. It is set plumb by a bob line suspended from a notch until it coincides exactly with a line drawn parallel with the edge (A). The

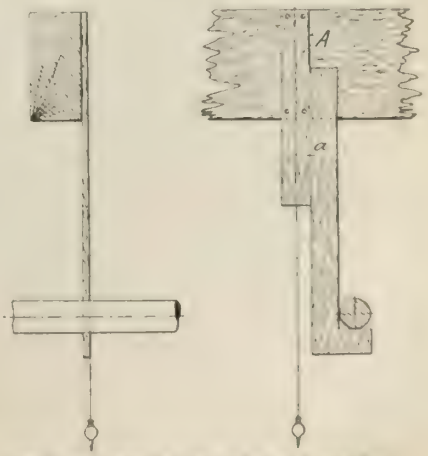


FIG. 16.—TEMPLET FOR HANGERS.

position of the edge (A) relatively to the shaft is of no importance. It may be 3 in. or 1 in. away, but the strip must be long enough to afford sufficient guidance to the second strip, say from 2 ft. to 3 ft. Also, the edges (A) will

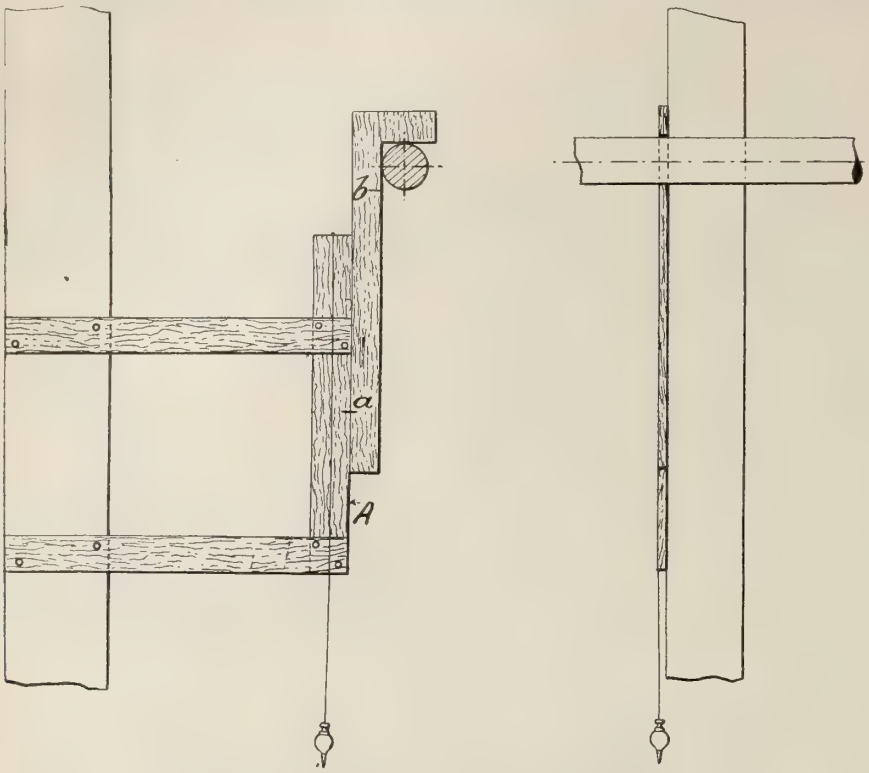


FIG. 17—TEMPLET FOR WALL BRACKET.

all be set exactly in line from the end bearings before being screwed finally. This will be done by stretching a straining line from end to end, standing out to a definite distance from the centres of the end bearings, from which line the edges (A) will be measured with a strip of wood all equidistantly. The vertical datum line will thus be set by the edge (A) of each piece, and all from the end bearings, the location of which is already fixed.

The next stage is to settle a horizontal datum line along the edges (A). Here also, position is not of importance but it is as well to have it a foot or eighteen inches from the shaft. This cannot be marked quite so accurately with a straining line as by the use of the level, though as stated in the previous article, a straining line fixed at one end and pulled taut by a suspended weight at the other the line passing over a pulley, will, in a shop of moderate length, have no perceptible sag. The safer way, however, is to tack a light straightedge on the faces (A) of the targets, taking two or three adjacent and starting from one end bearing and levelling with a spirit level, and thence marking the line (A) on the edge A of each target.

Now it is readily seen that the attachment of such a templet alongside each bearing, the edge of each one of which is equidistant from a strained line, and having the horizontal lines all marked at the same height as those on the end targets, affords a ready means for very approximate measurements for the positions of the successive bearings. From their edges and these lines, a

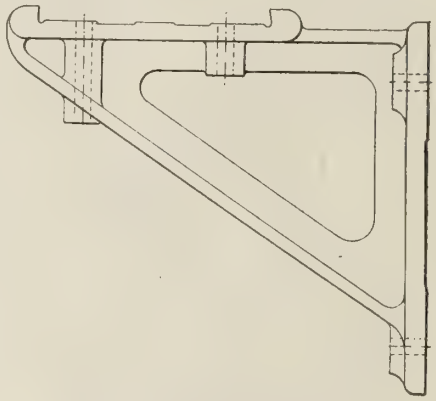


FIG. 18—WALL BRACKET.

square shaped templet (B) can be used set against the vertical edge, to locate the shaft and the bearing block.

Referring to Figs. 15, 16, 17, the method adopted in these is to use a square (B) cut to fit exactly over the shaft in the angle of the square, where a line on the edge is brought to correspond with the datum line (A) on the target. An earlier stage is represented by the line (b) which corresponds with the bottom of the shaft bearing in the pedestal, and which may be used when the packing strips are being planed for setting the vertical positions of the plummer blocks, hangdowns, or wall brackets.

Variations in details are merely matters of convenience to be modified in different cases. The essentials are the alignment of the edges (A) and of the lines (a). After the shafts are in place in their bearings, they can be checked for level by means of a spirit level, and slight corrections made if required by means of the packings under the bearing blocks or brackets, and for horizontal alignment by means of a straining line.

Rigid v. Swivelling Bearings.

If sufficient care is taken in aligning rigid bearings with plumb line and spirit level, they are not so unsatisfactory as the manufacturers of swivelling adjustable bearings say they are. I have known them running for very many years without giving any trouble whatever, merely entailing the renewal of a brass here and there at long intervals. This, of course, presupposes shafts of diameters large enough for their work, bearings placed sufficiently near together, accurately fitting couplings, and pulleys and gears hung properly, in addition to careful alignment.

However, even working under the best conditions, these rigid bearings are not to be recommended because they do not embody the best proportions of length to diameter. Being rigid, an ample length cannot be imparted without increasing the difficulties of aligning. In a swivel bearing, again, the weight and friction of the shaft are distributed over an area of about twice that obtainable in a rigid bearing. The mathematical demonstrations do not concern us here in an account of the methods of erection and the results obtained.

The foregoing remarks apply to bearings carried on any horizontal supports, whether on the timber beams of roof

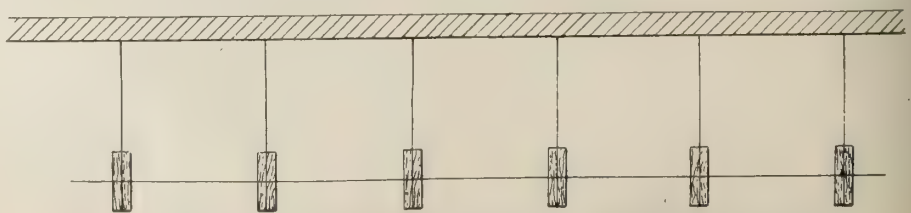


FIG. 19—LAYING DOWN CENTRES FOR WALL BRACKETS ON FLOOR

principals or longitudinal beams or girders of wood or steel placed for the purpose of carrying bearings, or on supports in the lattice braced pillars which carry the roof principals or the gantries of travelling cranes. The condition is that the bearings are bolted down, or up, to horizontal supports and have no provision for adjustment for height.

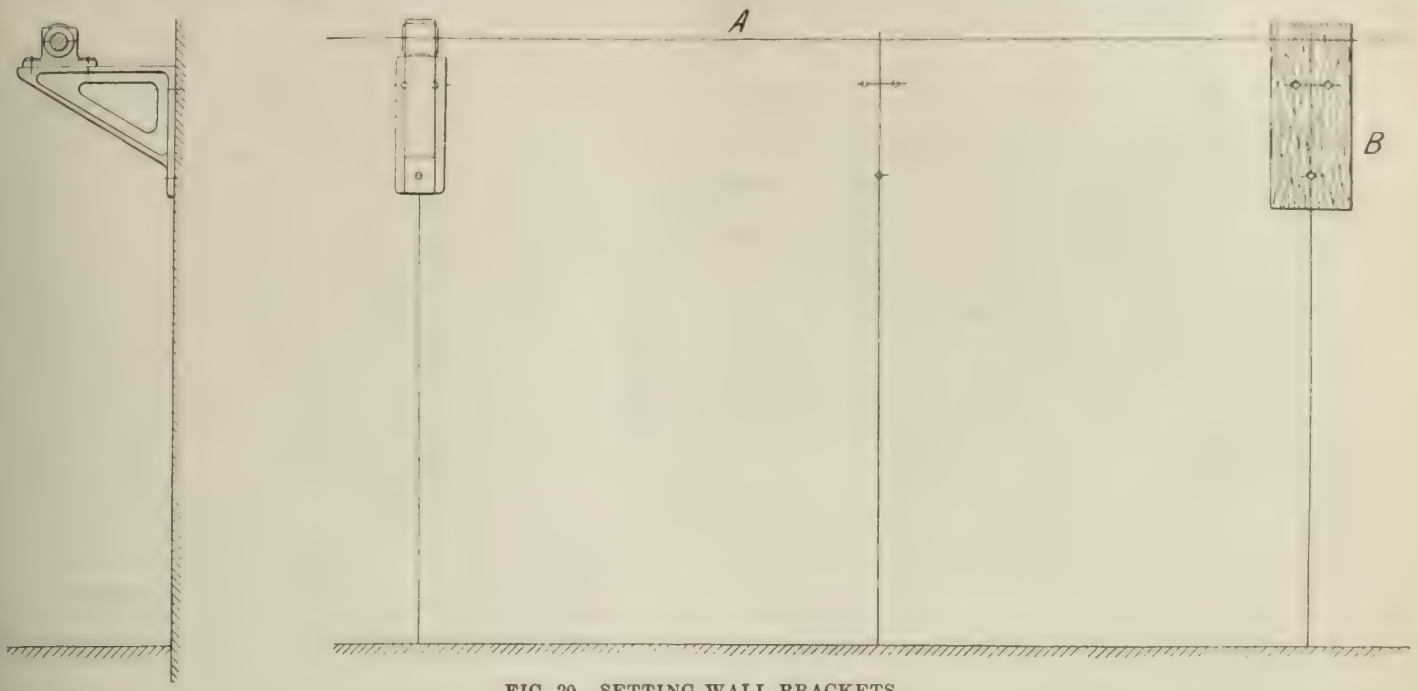


FIG. 20.—SETTING WALL BRACKETS.

Bearings in Wall Brackets.

Large quantities of shafting are carried in bearings supported on brackets bolted to walls. In these too, the bearings are either rigid, or they swivel and are adjustable. The methods of alignment previously explained are adopted after the brackets have been bolted up to the wall. This is done in the following manner:—

The centre line of the shaft being snapped on the floor, the centres of the brackets are marked across these at right angles up as far as the wall, Fig. 19. There, these are raised by a chalked plumb line set over each centre line in succession, and held at top and bottom and snapped, so transferring the lines to the wall Fig. 20. Measurement is then made up from the datum blocks on the floor, Fig. 19, to the wall, to the centre line of the shaft, using a rigid rod for the purpose. Then a line, (A) Fig. 20, is drawn along on the wall using a parallel straightedge and a scribe, and checking the horizontal truth of the straightedge with a spirit level. This will be the line of the shafting in its horizontal plane; or in some circumstances, it may be better to draw a datum line a foot or two above the floor, and measure the shaft line from that.

A templet (B) is made from the brackets corresponding with the feet. Along it, the centre line of the bracket is scribed, and across it the centre line of the shaft, and then the bolt holes are bored in their correct positions in relation to these lines. This templet is laid over the centre lines on the wall, and set to them by its centre lines, and the bolt holes are then marked off directly through it and drilled. The brackets are bolted up in succession, but each is adjusted from its predecessors by means of a parallel straightedge and level before all are made fast. Any slight subsequent adjustments are made in the bearings bolted to them subsequently by the methods already explained, that is, with plumb line, straightedge, and level.

Bearings on Steel Columns.

Brackets are bolted against the lattice braced steel columns which support roofs. This does not alter the method of lining out and fitting. The work is more awkward when they are fitted to round columns, as this requires a concave foot to the bracket, and a concave cap to bolt it up by, the bolts passing through lugs. Except that there are no bolt holes to be marked on the pillar, the general procedure as to centre lines and adjustments is similar to that already described.

Wall Boxes.

The fitting of wall boxes Fig. 22, may include one or more in line. In these a range of horizontal adjustment of the bearing in the box is provided, so that

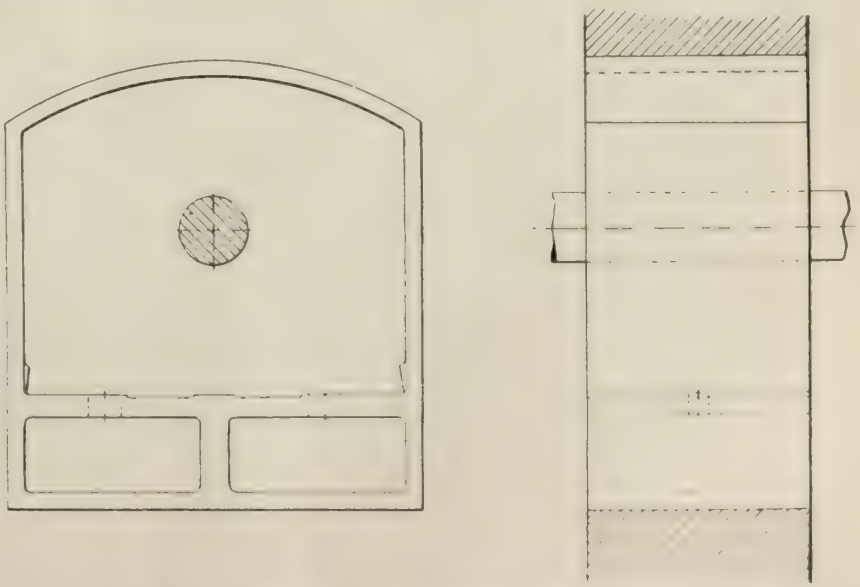


FIG. 22—A TYPICAL WALL BOX.

the fitting of the box itself is only made approximately correct. The actual bearing must be adjusted exactly with level and plumb line after the shaft is laid in, but a close preliminary adjustment can be made in the bearings with a straightedge laid from the bottom of that to the one adjacent, and tested with a spirit level.

Shafting in Crowded Shops.

If new shafting has to be put in a shop which is already crowded with machines, so that the floor cannot be used properly, the work is rather more awkward. There is usually some floor space available underneath the intended new shafting, and, if so, this can be utilized. Two plumb lines can be dropped, one

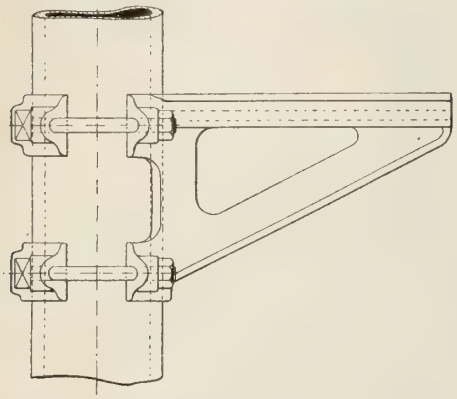


FIG 21—BRACKET ATTACHED TO COLUMN.

from an adjacent existing shaft, and another representing the place of the new shaft. These can be dropped in the two extreme positions, the distance apart measured with a rod, and the positions marked up on the beams, after which the procedure will be as before. If, however, a new line of shaft has to be erected over existing machines, the positions at the ends will be obtained by direct measurement from another shaft adjacent, using a rod for the purpose, and the centre lines will be marked on the beams with a scribe or by snapping a chalk line. No difficulties can arise which cannot be dealt with by making use of spirit level and plumb bob and rigid rods.

OBJECTIONS TO HOLIDAY EXAMINATIONS OF BOILERS.

IT is a common practice, says "Vulcan," for steam users to have the thorough examination of their boilers carried out at general public holidays. In many cases it is impossible, under existing conditions, for this practice to be avoided, however undesirable it may be, but, in large numbers of instances, other arrangements could equally well be made, and a boiler be prepared for thorough examination at some time between general holidays.

Firms very often have sufficient plant to allow for at least one boiler to be laid off at any time for cleaning and examination, but, even when this is the case, many people seem to think it necessary to have their boilers examined at a holiday time, without any regard to other people who are not so fortunately situated as themselves, and who have no alternative. Prudent firms provide themselves with spare boilers for the express purpose of having time to properly conduct the periodical cleaning, and of having the annual inspections carried out at a period when there is no reason for hurry, and when repairs, should they be necessary, may be effected without dislocation of their ordinary work. Such prudence is wiser and more far-reaching than appears at first sight.

Hurried Cleaning.

A boiler cleaned in a hurry is often not cleaned at all, and experienced inspectors are well aware that boilers habitually examined during public holidays are noted for the amount of deposit with which they are coated on the water side. Such an accumulation of scale makes satisfactory examination very difficult, if not impossible, since the condition of the boiler can only be judged by the appearance of such portions of the plates as happen to be visible, coupled with the inspector's knowledge of the general conditions under which it works. It is well nigh impossible in such cases to give an unqualified report.

The coal bills for which badly cleaned boilers are responsible often seem to be forgotten; at any rate, little or no effort is made to reduce them, though the saving of fuel in many cases would in a few years pay for the cost of an additional boiler. Boilers stopped only at general holidays likewise suffer from indifferent cleaning of the external flues, and here again there is often an economical loss through impeded draught due to the flues being more or less choked with soot.

Where as a precautionary measure, or as a matter of necessity, the removal of brickwork from the seatings or over the top of a boiler is desirable, it frequently happens that in the hurry at a holiday period such important and often necessary preparation is altogether ignored, or very inefficiently done. This hurry over preparation, or rather the want of it, is often due, not only to the shortness of time available at a holiday, but to eagerness of workpeople to get away, and it is a common experience of inspectors when making examinations at holidays to find no person present on behalf of the firm. In such cases, if the preparation is incomplete, which it generally is, no one is to be found to render it more perfect, and should any repair be required, there is no official to whom its scope can be explained. It too often happens that no preparation is made for the convenience of the inspector; no tools of any kind are provided, in the shape of hammer or chisel, etc., often even the necessary lamp or candle for lighting purposes is missing, while his personal comfort is altogether ignored.

To sum up the whole matter, the examination of boilers at general holidays is never so satisfactory as at other times. Owners of boilers do not get full justice from their cleaners, and for many economical reasons such inspections should, so far as possible, be avoided. From the point of view of the inspectors, the objections are just as strong. A desire to oblige as many clients as possible makes them extremely busy at such periods; lack of preparation makes the boilers more difficult to examine, and this, in turn, introduces an element of doubt in the results obtained, while the personal discomfort and disadvantages under which they have to perform their duties tend to accentuate matters.

AN ULTIMATE NECESSITY.

ELECTRIFICATION of steam roads is an ultimate necessity. Progress is, however, slow. It has been absolutely shown that electrification, particularly at points of heavy traffic, saves 25 per cent. to 35 per cent. in operating charges. It is the initial expenditure that causes every manager to hesitate. The average estimate runs close to $5,000 per mile.

Railroad men were slow to accept the merits of electric operation, but experiences of the great lines successfully conducting suburban zones have at last brought conviction. The saving has been demonstrated, flexibility of service and added comfort of passengers is admitted. It is now a question of capitalization, and uncertainty as to limitations that governing commissions might impose.

LOW WATT CONSUMPTION LAMP.

THE latest development in connection with a low watt consumption per candle-power is reported from Germany, where, according to the Electrical Review, the A. E. G. intends to place on the market in the autumn a new lamp which is claimed to consume only one-half of a watt per candle, as compared with .8 watt to 1 watt per candle of the existing wire lamps. It is announced that another firm, which manufactures Osram lamps, will also introduce a lamp having a similarly low watt consumption. The figures, of course, refer to the Hefner candle, which has a value about 10 per cent. less than English candle.

A Board of Trade Steam Valve Chest Explosion Inquiry

The evidence furnished goes to show that "water hammer" was the cause of the explosion, and as the subject is one of more than usual interest to operative engineers, and, at the same time, highly educative, we are reproducing the data and illustrations submitted by the B. of T. Surveyor, which contributed so largely in helping the Court of Inquiry to arrive at a decision.

BY THE explosion of a steam valve chest on board the Royal Mail Steam Packet Co. liner, Araguaya while in dock at Southampton on March 10 of this year, three boiler scalers were killed, and three others were injured, through the escape of scalding steam. At the Board of Trade investigation which followed, it was found that the valve which burst had been correctly designed and constructed, that it was free from flaws, and that it had been properly installed. The cause of the explosion as determined by the evidence was shown to be "water hammer," a contingency brought about by the accidental opening of a drain cock. In his evidence, Mr. C. W. Roberts, Board of Trade Engineer Surveyor, said:

"I examined the fracture with a lens. There was no flaw to account for the failure. The metal at the fracture was solid, having no blow-holes, and of a fine granular structure. Water passed freely through the port of the drain cock, equivalent to that which would issue from an orifice of a ¼ in. to ⅜ in. The strength of the valve chest cannot be determined with precision, but I estimate that the bursting pressure would be at least 1,600 lb. per sq. in., giving a factor of safety of 7½. These are rough calculations. The chest must have received a very great shock, and I am satisfied it could have resulted in no other way except from water hammer action, the circumstances, in my opinion, being ideal for the production of water hammer, for this reason: The branch pipe to which the chest was secured had a horizontal portion, and then it rose abruptly, and this formation would cause water of condensation to be entrapped in this part of the pipe.

The Water Hammer Feature.

I have prepared diagrams to illustrate in six stages how water hammer was probably formed, from the time that the drain cock was open, shortly before the explosion occurred, assuming it was so open, to the time of the explosion. The outlines of these diagrams are, of course, the same. The chest is indicated in section, and with it is the branch pipe leading into a portion of the main auxiliary pipe. Actually, the pipes and the chest were not in the same vertical plane as shown in the drawings. This branch pipe, after branching from the main pipe, was bent round at right angles to the main pipe. Then the horizontal portion was again bent round at right angles to meet the chest. In the diagrams, only the bend from the vertical to the horizontal portion is shown. It is shown as it is, so as not to confuse the issue. The conditions at the time of opening the cock, shortly before the explosion would be as represented in Fig. 1. The valve would be closed, and the chest, or portion of the chest above the valve, would be filled with water of condensation, as would also the branch pipe up to some level above the horizontal portion.

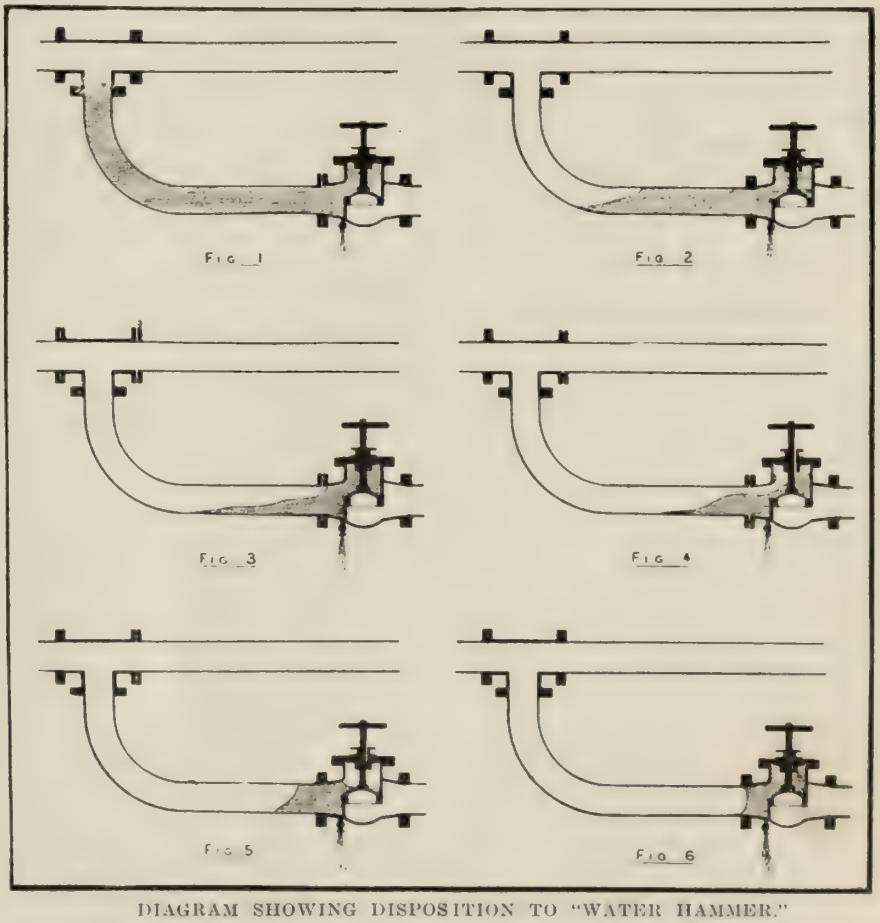


DIAGRAM SHOWING DISPOSITION TO "WATER HAMMER."

A point I wish to emphasize is this, that the neck of the chest would be completely filled with water, because, on the water draining into this pipe, and reaching the level of the top of the horizontal portion, steam would be entrapped in the chest. The sides of the chest and the surface water would be at the same temperature as the steam within the chest; but as the metal and water cooled down by radiation, the steam in the chest would be condensed, the process, of course, being very gradual, and the pressure of steam within the pipe, acting on the surface of the water within the pipe, would gradually force the water into the upper portion of the chest, which had been previously occupied by steam, so that the chest would be completely filled right up to the cover.

Now, the conditions which obtained would be the same as in Fig. 1. The surface water would be at the same temperature as the steam. Elsewhere, the water would be comparatively cool, especially at the bottom of the pipe and in the valve chest—in the positions most remote from the steam, and in which the water had been standing longest. On the drain cock being opened, the level of the water in the vertical leg of the pipe would gradually fall. The surface would remain unchanged as regards temperature and area until passing the first bend—that is the bend shown in the diagrams. On passing the first bend the surface would expand, the additional area being made up of cooler water—

that is, water that had been lying lower down in the pipe. On this cooler water being presented to the steam, condensation would occur.

The condensation would not be uniform over the whole surface of the water owing to the irregular temperature. The surface water would probably be cooler towards the inner radius of the bend of the pipe than towards the outer radius. This would result in the surface of the water no longer being level, but it would assume a more or less sloping position—as shown in Fig. 2—due to the irregular pressure on the surface of the water. The surface would be depressed where the water was hottest. Then, on the water continuing to be drawn from the pipe—steam would be admitted along the upper portion of the horizontal length. The process would be very gradual, because the drain cock was only partially open, so that the steam in its passage through the pipe would gradually heat up the water on its way. There would be no violent commotion of the water until the steam reached the valve chest. The position assumed by the water when the steam was at the entrance to the chest is shown in Fig. 3, and on gaining access to the chest the steam would displace the water which had been previously held up in the neck of the chest as shown in Fig. 4.

The Condensation Feature.

In falling by gravity the water would be suddenly agitated and would probably again block the pipe—as shown in Fig. 5. In blocking the pipe, steam would of course be imprisoned in the valve chest. This steam, on meeting the comparatively cool sides of the chest and the surface of the recently disturbed water would be suddenly condensed, and the block of water in the pipe would be propelled by the pressure of steam acting on its surface within the pipe into the vacuum caused in the chest, and it would strike the cover with enormous velocity—with sufficient force to fracture the neck of the chest, as I estimate. The ultimate position is shown in Fig. 6.

The length of the branch pipe to which the chest was attached scales about 7½ feet on the drawing, that is, the pipe itself from flange to flange irrespective of the branch of the T-piece. To fill that pipe with water beyond the bend, there must have been rapid condensation of the steam between 6 and 10.45 a.m. on the day of the explosion. According to the evidence there appears to have been no preliminary sign of knocking before the explosion occurred. Several cases have come to my notice in which there was no knocking. Of course, it depends on the arrangement of pipes. If the length of the horizontal portion is great relative to the diameter, one might expect a knocking to occur, and the rapidity with which the water is drained from the pipes has an important bearing on the subject.

The action is somewhat different when the steam is admitted to a long horizontal pipe in the lower portion of which there is relatively cool water. There is no doubt very rapid local condensation when steam is admitted, and it has been suggested that the steam in rushing through the restricted channel raises up behind it a wave which isolates the steam in the remote portion of the pipe, and this steam becoming suddenly condensed, the pressure wave is carried into the vacuum and delivers the water hammer blow; but it is incorrect to term the movement of this mass of water a "wave," which is a translation rather of form.

In all probability, the local condensation results in the sensible diminution of pressure at a particular place. This has the effect of heaping up the water at this particular place, due to the greater pressure elsewhere on the surface. The water is heaped up and, in assembling, is gathered up from the lower portion of the pipe. This exposes a fresh surface of the water to the steam, and the condensation is more rapid and causes a disturbance in other portions of the pipe. These heaps of water must oscillate owing to the irregular pressure. There is a violent agitation over the whole surface, which will continue so long as the temperature of the surface water differs from that of the steam.

For example, when steam is admitted into deck winch pipes in which there is water of condensation, they will almost immediately start to knock and vibrate, and this will continue until the pipes are thoroughly warmed up, or the water is expelled. The knocking is produced by the impact of the water against the side of the pipe as it fills the spaces left by bodies of steam on suddenly becoming condensed. This steam is entrapped or isolated by the water in the general commotion: it may be in the form of globules or in larger bodies separating blocks or plugs of water. The action of water hammer is in effect always the same. It is the movement of a mass of water by pressure on one side into the space occupied by lesser pressure on the other.

In my opinion, the valve chest was sound, and the failure was practically instantaneous, by reason of water hammer action. The whole of the theory that this rupture was brought about by water hammer action depends upon the fact that the drain cock must have been open prior to the explosion.

BURNING ANTHRACITE DUST.

THE usual practice when burning anthracite dust in connection with bituminous coal is to use a certain number of barrowfuls of dust with a given amount of soft coal, the proportions being varied in different places, and depending almost entirely on the experience of the fireman or engineer. Where the boilers are hand-fired, two or three barrowfuls of soft coal are dumped on the boiler-room floor, and over this is spread one or two barrowfuls of dust, the shovelling of the mixture into the furnace being depended upon to form a more intimate union of the different grades of coal. In some cases water is sprayed over the mixture before it is fed to the furnace.

There is no hard-and-fast rule as to the amount of water to use in wetting down the pile of dust, but it will be found that the mixture when wetted before being fired is better enabled to hold a lump shape, and this permits coking, which produces a more favorable condition for burning the dust. Whenever the mixture is fed to the furnace dry, there is little tendency toward coking; hence a smothered fire is produced, and poor combustion is the result.

It is evident, therefore, that the object of wetting the dust is to produce a lump formation which will facilitate coking. The best proportion of dust to use with soft coal is one that will effect a rapid dissipation of smoke, and at the same time maintain satisfactory steam pressure.

BALL AND ROLLER BEARING MANUFACTURE.

PROBABLY very few persons are aware of the extreme accuracy that is essential in the manufacture of ball and roller bearings. Obviously, however, where millions of balls and rollers are turned out, it is practically impossible to have the limit of error in every one of them exactly the same, despite its desirability. To obviate trouble resulting from such inaccuracy, a new machine has been put into use in the United States.

The rollers are fed on to a rotating steel disc, and passed in turn in front of delicate plungers arranged around the periphery of the disc; these plungers are in fact super-sensitive gauges capable of detecting differences of one-quarter of a ten-thousandth of an inch. When a roller touches a plunger, electrical contact is made, and the mechanism then drops the roller into a canister. The next roller may not touch a gauge until it has made almost the complete circuit, but it must touch one of them, and thus find its way into one of the receptacles. In making up the assembled bearings, all the rollers in any bearing must come from the same canister, thus insuring that all of them are as nearly the same size as human ingenuity can make them.

THE WORKING OF HEATING BOILERS.

By. F. J. Paton.

HEATING boilers used in churches, halls and other public buildings are often much neglected for long periods, and, as a rule, it is only when actual frost occurs, and there is no time for overhaul or examination, that they are thought of, and then hurriedly put to work. This has frequently led to explosions which might easily have been avoided by a little timely attention. Again, during frosty weather the fire is often lighted when a portion of piping is blocked with ice, in which case, if there be no safety valve, or if it be out of order, an explosion is inevitable.

Sources of Trouble.

Frost, however, is not the only source of trouble. Explosions may occur from other causes, such as the fitting of valves in the flow and return pipes, the inadvertent closing of which leads to excessive pressure. It is better to have no valves in the flow and return circuit of a heating boiler, the safety valve excepted, and that should be close to the boiler, and connected directly to it.

Imperfect circulation in high-pressure coils through shortness of water, or air in the pipes, is another source of danger in heating boilers, and has been the cause of many explosions. Here, it may be desirable to explain that heating boilers are usually worked on the "high-pressure" or the "low-pressure" system. In the "high-pressure" system, the boiler is simply an arrangement of strong iron or steel tubes, which are led round the premises and coiled a few times round the fire-grate fixed in the basement. This coiling assumes several forms, according to the fancy of the makers. In some it takes the form of a letter A, the cross bar of the A acting as fire-bars. In another form, the tubes at the furnace are arranged in a circle and laid horizontally with the fire beneath. The tubes in the circulating system are about 1 5-16 in. outside diameter and ⅞ in. bore, and generally of wrought iron lap welded; the connections being made by strong unions screwed with a fine thread.

At the highest point in the system, what is called an expansion chamber or pipe is fitted. This is usually about 4 in. diameter, and from 3 ft. to 5 ft. in length, and cannot be filled with water, as the top of the filling pipe is about 3 ft. below the top of the expansion pipe. The only other fitting may be, perhaps, a safety valve, which is often only about 1-16 in. diameter, and loaded to between 1,000 lbs. and 2,000 lbs. to the square inch. Under working conditions, the pipes are filled with water to the top of the filling pipe, and, this, the only opening, is then sealed with a screwed plug. Sometimes, instead of the filling pipe, there is a separate supply cistern and suitable valves to keep the system automatically filled to the desired height. When used for heating large buildings, 2,000 ft. to 3,000 ft. of piping are often required, and of this length about 200 ft. to 300 ft. is generally coiled around the furnace.

Low Pressure Heating Boilers.

"Low-pressure" heating boilers are of many designs, and are only intended for pressures up to about 40 lbs. per square inch, the actual pressure at which they are worked being determined by the head of water from the boiler to the supply tank. The vertical circular boiler with the fire inside, the saddle type, and the sectional cast iron boiler are best known. The circulating pipes of these boilers are generally of cast iron from 2 in. to 4 in. in diameter, and the system is kept full of water by a ball tap in the supply tank. Provided the pipes are not obstructed by deposit or ice, boilers of this type are fairly safe under working conditions. During periods of frost, however, this type is very liable to explode, as a comparatively low pressure is sufficient to cause failure. All boilers of this type should be fitted with a reliable safety valve. If such a valve is not fixed, then special care must be taken to ensure that the pipes are free from ice before starting the fire. This, however, is difficult to ascertain. Sounding the pipes where they are most likely to be blocked cannot be relied upon.

A good rule, when in doubt, is to watch the boiler carefully after the fire has been started, and if it becomes hotter than the hand can bear, and the heating pipes remain cold, it may be assumed the pipes are not clear, and the fire should be immediately withdrawn, otherwise steam will be generated, and sooner or later cause explosion. This test cannot, of course, be applied with high pressure coils. Another precaution with all types of heating boilers during frost is to keep the fire burning continuously until the thaw sets in, although this is often inconvenient and sometimes not practicable. A safety valve should always be fitted, a deadweight type is preferable to a lever or spring valve, and the valve should be fitted direct to the boiler. This fitting should be lifted from its seat occasionally under working conditions, and also thoroughly overhauled at least once a a year.

Domestic Hot Water Boiler.

The ordinary domestic hot-water boiler can hardly be described as a heating boiler, although the conditions under which it works are much the same as the low-pressure heating boiler already referred to. The service pipes of domestic boilers being more protected are not so liable to be affected by frost; but as there are always a number of explosions in severe weather, caused by the water in the pipes freezing at exposed positions, precautions should be taken at such times. Before lighting the fire on a frosty morning, the hot-water taps about the house should be turned on, and if the water does not flow in the usual way, the fire should not be lighted, as it is quite sufficient to prove there is an ice block somewhere in the system, and to light the fire under such circumstances would be dangerous, unless of course the apparatus be fitted with a safety valve.

Steam Heating Boilers.

Steam heating boilers are generally of the vertical or sectional type, and are worked under the same conditions as an ordinary boiler. Such boilers should have a full set of fittings, namely, a safety-valve, pressure gauge, feed valve, blow-off tap, and if the construction permits, a fusible plug. Assuming the heating pipes are properly drained back to the boiler, there should be no particular risk from frost as in the case of water heating boilers. Steam heating boilers, however, require constant attention, as the water level has to be maintained within narrow limits, and if boilers are of cast iron any slight overheating may result in cracks or other damage. Good water should be used, and the boiler cleaned out at regular intervals. Taps should not be fitted to these boilers for the purpose of drawing off water for washing purposes, as this may seriously lower the water level. Steam should be raised very gently with all cast-iron boilers, and particular care should be taken by regulating the dampers to prevent as far as possible cold air passing into the furnace when the fire door is opened during stoking.—From an article appearing in a recent issue of Vulcan, by a member of the company's staff.

THE SERIES MOTOR.

THE series motor is employed in automobile work almost exclusively, its high starting torque constituting a practical advantage that so far has offset the defects of momentarily heavy copper losses, and consequently reduced efficiency during acceleration periods. Experiments have been made with compound-wound motors, and with regenerative making systems, but there seems little likelihood of such systems finding favor with the lighter types of vehicle, although for heavier work the possibilities are more hopeful.

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THE FACTORY POWER SITUATION.

THE more or less frequent interruptions, which Ontario manufacturers have recently experienced through the failure of their electric power supply, have not been such as to inspire confidence in the all sufficiency and dependability of a motive power whose transmission from the source of generation to its place of application, involves long, exposed and apparently easily vulnerable lines.

It seems to be forgotten that power users are out for the power supply that will pay them best now, and on this ground only must any public utility corporation who cater to them be judged. Shut-downs are becoming of a more frequent and prolonged nature, and no self respecting management can afford to allow its business to be demoralized with impunity by any power corporation.

The works or factory power plant is more dependable than any source of power, where long transmission lines intervene, and we are rather of opinion that the overdue return to its own of the individual power plant is within measurable distance.

TRADE PAPER EDITORIAL CODE.

THE precepts herewith were first given expression to by their author, J. George Frederick, in a speech delivered before the Grocery Trade Press Conevntion, and were read later before the Allied Trade Press.

The co-operative efforts of those responsible for The Power House publication are, needless to say, shaped in conformity with the ideals herein set forth, and the measure of success in compassing these, has been such as to merit the commendation of advertisers, non-advertisers, and subscribers alike.

Never discriminate in editorial columns between advertisers and non-advertisers; either by what you say or what you do not say, or by the way you say things.

Never, even in the subllest way, turn the weight of your influence against your readers' interests—either by printing certain articles or editorials, or by failing to print them, or by minimizing and discrediting.

Never print a single word or line furnished by an advertiser which you wouldn't publish if it came in through the regular editorial channels.

Accept no advertising contingent upon the publication of any editorial matter.

Have no favorites in the field among advertisers, whether that favoritism is conscious or unconscious.

Never worry about an advertiser's kick about your editorial policy, if that policy is wholesome, constructive and in your readers' best interests.

Treat personal items about advertisers, and individuals connected with them, exactly as you treat others, for be sure that personal favoritism or personal knocking is quickly sensed and judged by readers, no matter how subtly done.

Give your properly appointed editors a thorough education in the practical, but high-minded ethics of editing, and then let them be the final judges of editorial questions which arise in relation to advertisers or advertising.

Standardize your advertising solicitors' replies to all efforts of advertisers or others to use influence editorially: "Our editors must be the judges of such matters; get in touch with them; they will be glad to consider any suggestion. I am authorized to talk only about advertising."

Keep editorial department in practical touch with advertising department, but simply to study the pulse of the field as evidenced by the activity in its "selling end" (the advertisers), so as to turn around and the more accurately and completely serve the "buying end" (the subscribers).

ELECTRICITY AND HYDRAULICS

This department is intended, in addition to individual treatment, to feature the close relationship existing between electricity and hydraulics in the power and light field.

KAMINISTIQUIA POWER DEVELOPMENT.

INTERVIEWED by the Fort William Times-Journal, Mr. R. S. Kelsch, consulting engineer, Montreal, stated that his recent visit to Fort William was in accordance with instructions from President Holt of the Kaministiquia Power Co.

Owing to the general conditions throughout the country, it was felt that the company should, if found advisable, carry out as much as possible any contemplated constructions, during the next twelve to eighteen months, while the financial stringency was general and for that very reason, where work would be slack elsewhere and factories not running up to capacity, the plant could be installed at a very material saving and economy over what it could be done for two or three years later.

Making Surveys.

At the present time the company are making preliminary surveys, putting camps in shape, and in general anticipating an order to go ahead as soon as Mr. Kelsch can submit his report on the engineering advantages and dependent on Mr. Black's recommendations.

It will be appreciated that under existing financial and general conditions the company will hardly proceed with the outlay of such a large expenditure of money as would be involved in the carrying out of the proposed plans except after the most careful considerations.

With reference to the size of the new units, these would either be two of the same size at the present, viz., 5,000 horse power, or else one single unit between 10,000 and 15,000 horse power, whichever appears most advisable.

In the face of power failures elsewhere it is being more generally realized that where a community depends to such an extent as it does on electric service, the most important factor is that of continuity of service.

The Hydro Failure.

In the case of the recent unfortunate mishap to the hydro service in Eastern Ontario it has been estimated that the loss to the community served, in lost time and inconvenience to the public, was upwards of one hundred thousand dollars, and this feature must ever have the very best and closest attention of our consulting engineers, our operating organizations and our directors, having a proper regard for the public they serve.

While the present work is somewhat in advance of the immediate necessities, it but carries out the past policy of the company, to at all times maintain ample reserve equipment and assure the best possibly service.

Take Pride in Plant.

Mr. Kelsch referred to Mr. Holt's pride in their Kakabeka Falls plant, which Mr. Holt considers one of the very best of its kind and size anywhere on the continent, and holds the record for that standard of service which they have endeavored to secure. It is interesting to note that the management and local organization is practically the same as that from the commencement of operation in 1906.

It has always been the policy of the company to promote its men in the service, and to become a live factor in the life of the community which they serve.

Loyal to Fort William.

All their work is carried on by the company, supplies purchased locally as much as possible, and as all moneys are paid through the Fort William office, the expenditure that would take place would be of as much direct benefit as though the work were carried on inside the city limits.

While the company were preparing all the preliminary work and estimates no work on a big scale would be undertaken until their information was all in hand, nor would any definite decision be made until the return of W. A. Black, the managing director of the company, who is at present on his way from Europe, and is expected in Fort William in the course of the next couple of weeks. On Mr. Black's recommendations or otherwise will practically depend what the ultimate decision will be, but if favorable then the company would press forward all extensions as fast, and on such a scale, as the various conditions warranted during the next two years.

HYDRO-ELECTRIC COMMISSION AND CHATS FALLS.

CHIEF Engineer Gaby and Hydraulic Engineer Acres, of the Ontario Hydro-Electric Commission, with Mayor Ellis, M.P.P., of Ottawa, and several engineering experts from Toronto and Montreal, made an inspection trip relative to the water-powers of Chats Falls, on the Ottawa River, some thirty miles west of Ottawa.

Expropriation proceedings instituted by the Hydro-Electric Commission are pending before the Ontario Railway and Municipal Board, with a view to taking over the present power rights held by Hardy and O'Connor at Chats Falls under a lease granted by the Federal Government in 1911. The Ontario Government has offered $420,000 to the present owners, but they ask three million dollars. The evidence in the case will be heard in September.

The inspection trip was made with a view to enabling the appraisers for the Hydro-Electric Commission to get first-hand information as to the power development possible, and the value of the lease now held by Hardy and O'Connor. The Ontario Government intends to use Chats Falls power as an extension of the Provincial power system for the Ottawa Valley and Eastern Ontario. Over 100,000 horsepower can be developed at the Chats and Ottawa, and the whole surrounding district is vitally interested in the move now under way for insuring cheap power through Provincial development at the Falls.

TEMPERATURE OF TURBO-ALTERNATOR APPARATUS.

THE temperatures actually obtainable are liable to be materially higher than the usual methods of measurement will indicate. A rough measure can be

obtained by exploring coils or thermo-couples, but it is evident that such coils, if placed next to the copper, will not give the correct temperature measurement if the flow of heat is from the iron to the copper, while a coil next to the iron will not give the correct result with the flow from the copper to the iron. The manufacturer, with his guarantee of 40 degrees C. by thermometer, actually builds for possible temperatures of 70 degrees to 90 degrees C. in some parts of the machine, for he expects to find fairly high temperatures in some cases with exploring devices. The usual guarantee of 40 degrees C., therefore, should be considered as only a relative indication of a safe temperature in such apparatus.

SQUIRREL CAGE TYPE MOTOR.

THE squirrel-cage type motor easily holds the field for general work in the cement mill. A good method is to have a combination of group and individual drives, grouping all the heavy machines and using small motors for the lesser drives, such as conveyors, elevators, etc. The choice of frequency is not of very great importance; anything between 25 and 63 periods is suitable. Of greater importance is the choice of voltage.

With group driving, the 2,200-volt system can be installed to great advantage with perfect safety, but such is not the case with individual driving. The smaller machines should be driven at 550 volts as a maximum. The wiring is best carried out on the open principle, with everything in full view, this system being carried right up to the motor wherever possible.

HEATING OF CIRCUIT BREAKER CONTACTS.

IN the Electrical World, F. W. Harris points out that a common source of complaint is the heating of the contacts of circuit breakers after the apparatus has been in service for a long period. These breakers, as commonly constructed, have a laminated brush made up of thin leaves of copper, and any temperature over a certain very well-defined maximum will result in the brush becoming soft and losing its elasticity. The heating therefore, becomes very much worse, rapidly approaching a crisis which results in a more or less total ruin of the brush and sometimes a shut-down of the plant.

In a certain case, an examination of conditions showed that the troublesome circuit breakers were connected on a circuit that was never opened, except upon dead short circuit conditions, and these conditions did not obtain more than once or twice a year. The whole trouble was traced to a gradual oxidation of the contacts, and to the fact that the troublesome circuit breakers were never opened and closed to rub off the oxide. It was found that if the breakers were opened and closed a few times on Sundays, it was possible to keep the contacts bright.

HYDRO-ELECTRIC POWER MACHINERY CONTRACT.

THE unique position occupied by the Canadian General Electric Co. in the design and construction of Hydro-Electric power machinery is well shown in the contract recently awarded by the West Kootenay Power and Light Co. of Rossland, B. C., In order to increase the capacity of its plant, the latter company decided upon the addition of a 7,500 K. V. A. water wheel driven generator.

The Canadian General Electric Co. will build the generator, while the contract for the water wheel was placed with its subsidiary, the Canadian Allis-Chalmers, Ltd. This water wheel will have a capacity of 9,000 h. p. at 180 r. p, m., under a head of 70 feet. The contract, therefore, will be carried out practically by one firm, who are thoroughly familiar with the design and construction of both electric and hydraulic portions, and with the conditions necessary for their successful operation as one unit.

It is understood that the increase in the generating capacity of the West Kootenay Power and Light Co. has been undertaken in anticipation of the electrical requirements of the Canadian Pacific Railway which intends to electrify the line between Rossland and Castlegar. The contract for the electrification of this section of the railway was also awarded a short time ago to the Canadian General Electric Co.

LONG SAULT POWER.

THE Hon. Clifford Sifton is revising the engineers' report of the Conservation Commission on the Long Sault dam project. From an engineering standpoint the dam is feasible, although it is believed that there will always be some risk as regards flooding. However, in spite of this latter danger it is thought better that power be developed on the Canadian as well as upon the United States side. The Commission is in favor of the State rather than a private corporation taking up the necessary development work. It is expected that this development work will mean serious interference with navigation on the St. Lawrence.

MOTORS FOR REVERSING ROLLING MILLS.

A GERMAN firm is now building single motors for driving reversing rolling mills, with outputs up to 15,000 horse-power. One of the difficulties to be met was that, owing to the necessity of keeping the diameter of the armature as small as possible, unsatisfactory cooling conditions were set up. After many experiments, the firm has now definitely adopted the plan of cooling such motors by means of compressed air drawn from the outside. The stator is covered in on the opposite side to the commutator, except for a few small openings, the rotor being closed on the commutator side. The cooling air, which is led to the motor through filters by means of special fans, enters through an aperture in the neighborhood of the shaft, whence it follows a predetermined course. Part of the air is forced through the core slots, part through the openings in the motor covering, to cool the commutator, while the remainder is driven through the stator coils or through the air gap between the rotor and stator.

CANADIAN LIGHT, HEAT & POWER COMPANY.

THE annual meeting of the shareholders of the Canadian Light, Heat and Power Co. was held on August 5, at Montreal, the President, Mr. F. Howard Wilson, in the chair. The annual statement and directors' report were read and considered highly satisfactory.

The chairman stated that the connected load on the company's system amounted to 26,538 horsepower, while the number of light customers was 5,144, and of power customers, 581. He said that the company's distributing system was spread throughout the city of Montreal, from the borders of Lachine to Point aux Trembles, and from the St. Lawrence to the Black River.

The old Board was re-elected, the directors being:—F. Howard Wilson, President; E. A. Robert, Vice-President and Managing Director; Hon. N. Curry, Hon. J. M. Wilson, G. G. Foster, K.C., J. M. McIntyre, J. W. McConnell, W. C. Finley, F. J. Shaw and R. N. Smythe.

The officials of the company are; H. B. Malison, Secretary-Treasurer, and K. B. Thornton, Assistant Manager and Chief Engineer.

REFRIGERATION DEPARTMENT

CAPACITY OF AMMONIA COMPRESSORS.

REFRIGERATING capacity of a compressor depends upon the number of pounds of gas it will handle in a given unit of time. The weight of ammonia gas handled depends upon the efficiency of the compressor and upon the suction pressure, or the pressure at which the gas is delivered into the compressor.

Since the weight of ammonia gas varies approximately as the absolute pressure, it follows that the refrigerating capacity of a compressor varies with the absolute suction (or back) pressure; thus, a compressor, working under a suction pressure of 30 lb. gauge pressure, will have approximately 50 per cent. greater capacity than one working under 15 lb. gauge pressure.

To determine the refrigerating effect produced by the evaporation of 1 lb. of liquid ammonia at a given back pressure, a deduction must be made from the latent heat of evaporation at that pressure for the work required to cool the ammonia itself from the temperature at which it enters the evaporating coils to the temperature at which the evaporation takes place.

The temperature at which the ammonia enters the evaporating coils should be approximately that of the water used for condensing purposes.

The accompanying table shows the number of cubic feet of gas that must be pumped per minute at different suction and condensing pressures to produce 1 ton of refrigeration per 24 hr. The values given are theoretical, and it is assumed that the temperature of the ammonia entering the evaporating coils corresponds to the temperature of condensation at the pressures given, and no allowance is made for unavoidable losses.

To obtain the net refrigerating effect of a compressor, it is, therefore, necessary to determine:

1.—The suction, or back pressure.

2.—The temperature at which the ammonia enters the refrigerating coils.

3.—The percentage of allowance to cover unavoidable losses.

TABLE I. REFRIGERATING EFFECT OF 1 CU. FT. OF AMMONIA GAS AT DIFFERENT CONDENSER AND SUCTION (BACK) PRESSURES IN B.T.U.

Temperature of Gas in Degrees F.	Corresponding Suction Pressure Pounds per Square Inch	Temperature of the Liquid in Degrees F. 65	70	75	80	85	90	95	100	105
		Corresponding Condenser Pressure (gauge) Pounds per Square Inch. 103	115	127	139	153	168	184	200	218
	G. Pres.	27.30	27.01	26.73	26.44	26.16	25.87	25.59	25.30	25.02
—27	1	33.74	33.40	33.04	32.70	32.34	31.99	31.64	31.30	30.94
—20	4	36.36	36.48	36.10	35.72	35.34	34.96	34.58	34.20	33.82
—15	6	42.28	41.84	41.41	40.97	40.54	40.10	39.67	39.23	38.80
—10	9	48.31	47.81	47.32	46.82	46.33	45.83	45.34	44.84	44.35
— 5	13	54.88	54.32	53.76	53.20	52.64	52.08	51.52	50.96	50.40
0	16	61'50	60.87	60.25	59.62	59.00	58.37	57.75	57.12	56.50
5	20	68.66	67.97	67.27	66.58	65.88	65.19	64.49	63.80	63.10
10	24	75.88	75.12	74.35	73.59	72.82	72.06	71.29	70.53	69.76
15	28	85.15	84.30	83.44	82.59	81.73	80.88	80.02	79.17	78.31
20	33	95.50	94.54	93.59	92.63	91.68	90.72	89.97	88.81	87.86
25	39	106.21	105.15	104.09	103.03	101.97	100.91	99.85	98.79	97.73
30	45	115.69	114.54	123.39	112.24	111.09	109.94	108.79	107.64	106.49
35	51									

Average Practice.

In the operation of a plant, it has been found that the following conditions represent fairly average practice:

Back or suction pressure, 15.67 lbs. above atmosphere, at which pressure ammonia evaporates at zero; condensing water at 60 degrees F., which gives ammonia liquid a temperature of about 65 deg. F.; under these conditions it requires the handlling of about 7,500 cu. in. of gas per minute to produce the effect equal to melting 1 ton of ice per 24 hours.—Ice.

REFRIGERATING MACHINES.

IN a paper on "Vapor Compression Refrigerating Machines," read before the Institution of Mechanical Engineers, Mr. J. Wemyss Anderson remarked that enormous progress had been made in the use of refrigeration. The value of food-stuffs imported and, subjected more or less to refrigeration, together with the application of refrigeration to home produce, to manufactures, to industries, and to many miscellaneous purposes made the subject one of great importance to scientists and engineers. Recent progress, however, had been more of a commercial nature than a scientific one; indeed, no branch of mechanical science had received less aid from research or from published accounts of practical pro-

TABLE II. NUMBER OF CUBIC FEET OF GAS THAT MUST BE PUMPED A MINUTE AT DIFFERENT CONDENSER AND SUCTION PRESSURES TO PRODUCE 1 TON OF REFRIGERATION IN 24 HR.

Temperature of Gas in Degrees F.	Corresponding Suction Pressure Pounds per Square Inch.	Temperature of the Gas in Degrees F. 65	70	75	80	85	90	95	100	105
		Corresponding Condenser Pressure (gauge), Pounds Per Square Inch. 103	115	127	139	153	168	184	200	218
	G. Pres.									
—27	1	7.22	7.3	7.37	7.46	7.54	7.62	7.70	7.79	7.88
—20	4	5.84	5.9	5.96	6.03	6.09	6.16	6.23	6.30	6.43
—15	6	5.35	5.4	5.46	5.52	5.58	5.64	5.70	5.77	5.83
—10	9	4.66	4.73	4.76	4.81	4.86	4.91	4.97	5.05	5.08
— 5	13	4.09	4.12	4.17	4.21	4.25	4.30	4.35	4.40	4.44
0	16	3.59	3.63	3.66	3.70	3.74	3.78	3.83	3.87	3.91
5	20	3.20	3.24	3.27	3.30	3.34	3.38	3.41	3.45	3.49
10	24	2.87	2.9	2.93	2.96	2.99	3.02	3.06	3.09	3.12
15	28	2.59	2.61	2.65	2.68	2.71	2.73	2.76	2.80	2.82
20	33	2.31	2.34	2.36	2.38	2.41	2.44	2.46	2.49	2.51
25	39	2.06	2.08	2.10	2.12	2.15	2.17	2.20	2.22	2.24
30	45	1.85	1.87	1.89	1.91	1.93	1.95	1.97	2.00	2.01
35	51	1.70	1.72	1.74	1.76	1.77	1.79	1.81	1.83	1.85

gress than that of mechanical refrigeration.

The field for research was very great, and included the machinery proper, the construction, equipment and insulation of land cold storages, the design of ships for carrying refrigerated cargoes, the construction of ammunition magazines (chiefly naval), transportation and storage of perishable produce, the right temperature for storing various goods, the importance of steady temperatures in fruit carrying and similar cases, the methods of registering temperatures, and the condition of the air in cold storage with regard to its temperature, purification (ventilation), humidity, and effect on the goods stored. This list might be extended if references were made to industries, such as the drying of the air for blast-furnaces, chemical works, soap works, etc.

Types of Machines.

The principal types of refrigerating machines in general use were:—

(1)—Vapour compression machines.
(2)—Ammonia absorption machines.
(3)—Cold-air machines.

The last-named were not now relatively so important as formerly, and the ammonia absorption machines—an important section—could hope to hold their own against compression machines only where waste steam or waste heat in some other form was available. Commercially, the first type was by far the most important, and therefore the paper was confined entirely to them.

Action of Refrigerating Machines.

Heat would naturally flow from a warm to a colder body, but if a quantity of matter was to be made colder than its surroundings, heat must be removed from it by the expenditure of work. This action was the function of a refrigerating machine, which, in consequence, was often spoken of as a "heat-pump." A heat-pump was a reversed heat-engine.

In the vapour-compression machine, a liquid (refrigerant) was vaporized in the evaporator by the supply of a quantity of heat from the body (or fluid) to be cooled. The vapor so formed was drawn into the compressor, and then, by virtue of work expended, it was forced into the condenser, where it was liquidified, generally by the agency of water. By means of a regulating valve the liquid was allowed to pass in regulated quantities into the evaporator for re-evaporation. This liquid should be kept as low in temperature as possible.

The vapor was brought back to the compressor in a somewhat wet state (i.e., particles of liquid suspended in it) and the amount of superheat was relatively small, making the use of a water-jacket unnecessary. In the United States as much "cooling effect" was taken out of the vapor as possible, and it went to the compressor in a dry or super-dry state, and generally became highly superheated on compression, the compressors being water-jacketed, although recent practice pointed to the adoption of the British method of working, which was known in the United States as the "flooded" system.

Refrigerants.

Thermodynamically, it did not matter what fluid was employed in a heat-engine or reversed heat-engine, yet certain characteristics, physical properties, and practical considerations limited the choice. Water-steam had never been seriously challenged as the most suitable fluid for engines working on the Rankine cycle. In the vapor-compression refrigerating machines, however, no one fluid held an unchallenged position; a number were employed, of which three were of outstanding importance—viz., anhydrous ammonia (NH_3), carbonic anhydride (Co_2), and sulphurous anhydride (SO_2). These were able to stand the temperatures and pressures employed (water, for instance, was not available, as it would freeze at the low temperatures required in refrigeration); their capacity for heat was great and they possessed low temperature vaporizing points.

The practical preference for NH_3 over SO_2 appeared to lie in the fact that for all ordinary working temperatures, the pressures for NH_3 were above the atmosphere, and with any leak the ammonia made itself felt, while for SO_2, air might leak in without indication.

The distinct advantage of CO_2 was that it was practically inodorous. If reliable tests proved CO_2 to be as inefficient as theory pointed out, the machine would still justify its use on large passenger steamers, but it would be difficult to justify its use on, say, a man-of-war. Such a vessel might live its life without going into action, and supposing an ammonia machine were fitted, it would be quite easy to blow off the charge before coming in touch with the enemy. Finally, in comparing the three refrigerants, it should be said for a given refrigerating effect SO_2 was the largest machine and CO_2 the smallest, but the working pressures (and hence thickness of metals) were in the reverse order, so in regard to weight and cost there wes very little to choose between the three types of machines.

Conclusions.

The author then discussed in detail the principal parts of all vapor-compression machines—viz.:—

(1)—Regulating valve.
(2)—Evaporator.
(3)—Compressor.
(4)—Condenser.

He also discussed the general arrangement of the plant in a milk cooler, a cold store, and a ship. In presenting his conclusions, he observed that vapor-compression machines had the merit of a wonderful simplicity, and practically a standardization of design.

The two outstanding requirements in refrigeration were:—

(1)—A standard unit of refrigeration—say, a "ton of refrigeration" of fixed value in B.Th.U.'s, and taken between standard limits of temperature.

(2)—A standard refrigerating machine of comparison. Both these wants could be satisfied by a conference with leading makers.

Careful research was also required to determine:—

A—The relative efficiencies of the principal refrigerants at varying temperatures.

B—The advantages and disadvantages of both wet and dry compression.

C—The value of compound compression.

D—The effect of the varying amount of refrigerant used in a given machine (undercharged and overcharged machines).

E—The value of cooling the liquid refrigerant in (or by) the evaporator before expansion.

F—Deterioration and fatigue of the refrigerant due to constant re-use, effect of foreign vapors (such as water or oil) in the closed circuit, value of by-pass driers or scrubbers.

LONDON No. 30, C. A. S. E.

AT the last regular meeting of Lodge No. 30, Canadian Association of Stationary Engineers, London, Ont., held in their rooms, 211½ Dundas Street, the following officers were installed for the ensuing year by Past President G. D. Fowler:

Past President—W. J. Paynter.
President—J. E. Middleton.
Vice-President—G. F. Galloway.
Recording Secretary—W. G. Walters.
Assistant Recording Secretary—R. Warren.
Financial Secretary—Wm. Costello.
Treasurer—W. C. Rogers.
Conductor—George England.
Doorkeeper—Charles Husband.

D. F. Campbell was appointed to represent the lodge on the City Board of Trade.

Escher Wyss & Co., Montreal, notify us that Mr. C. J. Printz no longer represents them in the Province of Ontario.

Practical Questions and Answers for Engineers

The present Q. and A. series from the N.E.L.A. Bulletin, consists of selected questions from power plant operators seeking information, and the replies thereto, by those of their conferes and others who are equally able and willing to oblige. We hope to supplement and widen the scope of this particular department in succeeding months.

Q.—For a small electric light plant, which is the better system of ice-making, the compression or the absorption? Please give reasons.

A.—In small plants, the compression system is preferable. It is less complicated and requires less water.—R. L. Lloyd, Philadelphia Electric Co., Philadelphia, Pa.

* * *

Q.—Why is it that the load curve of the exciter does not more nearly parallel the load curve of the generator it is exciting?

A.—The exciter load curve does not parallel that of the generator because the generator field requires considerable excitation at no load to maintain rated voltage at the generator terminals. Furthermore,, at a given load greater excitation is required to maintain normal voltage when the power-factor is low than is needed with unity power-factor, for the reason that the lagging armature current tends to demagnetize the fields. —Laurent Heaton, Orange County Lighting Co., Middletown, N.Y.

* * *

Q.—We furnish a sanitarium with steam for sterilizing at 150 pounds pressure through a ⅜-inch steam pipe. The line is straight about 2 ft. long, and opens into a ¾-inch pipe, hence there is practically no back pressure. State the pounds of steam that will flow through the pipe in one hour?

A.—There has evidently been a mistake made, as 8,000 lb. of steam at 150 lb. pressure per hour is about right for a 1-in. orifice. Steam flow into the atmosphere (practically no back pressure) as estimated from steam tables for steam at 150 lb. boiler pressure, will approximate 128 lb. steam per square inch area per minute or about 7,680 per hour. A ⅜-inch. orifice has an area of about 0.11 sq. in., but a ⅜-in. standard pipe has an area of about 0.19 sq. in. The steam discharged per hour through a ⅜-inch orifice would be approximately 845 lb., and through a standard ⅜-in. pipe about 1,460 lb. in place of the 8,000 as stated.—C. J. Carlsen, Commonwealth Edison Co., Chicago, Ill.

* * *

Q.—Has the chain drive been found satisfactory for continuous service? How has the cost of maintenance compared with that of other drives?

A.—We have been using chain drives for some six or seven years. We have chain drives on heavy, reversible elevator duty that have not cost one cent for repairs. In fact we know of some 80 chain drives on elevators in and around Baltimore which do not give any trouble at all, and of but one that was ever renewed, and that because it was never oiled. We believe that any good chain drive will save its first cost over a belt drive in five years. There are two general types of chain drives on the market. One has centre links to keep it on the sheave, and the other has wire flanges. The drive with the centre links will often jump off when it has run quite a while and worn the rocker pins, and this drive does at times give trouble from the wearing of the links by the pins. Another make of chain drive, the link belt drive, has bushings which are so arranged that no wear could possibly occur in the holes in the links, and this drive can be made practically new and brought back to its original pitch by simply purchasing new bushings and new pins. These, however, would be needed only in cases of extremely bad service conditions, and neglect of oiling. This drive is kept on the sheaves by flanges and we have never known one to jump off, for which reason we prefer it for reversible elevator work. We also have a 35-h.p. drive which has been running a positive blower for some two years, besides a number of other drives too numerous to mention, and notably in the clothing manufacturing line. We do not know of a single bad chain drive in this vicinity.—Guy K. Mitchell, Standard Electric & Elevator Co., Baltimore, Md.

* * *

Q.—Why are some alternating-current generators rated in kilovolt-amperes instead of kilowatts, and what is the difference in meaning? Is there anything in print giving an explanation of the difference between these two ratings which can be used to instruct beginners?

A.—The kilovolt-ampere rating expresses the electrical output. The kilowatt rating expresses mechanical or actual energy output. Kilovolt-ampere is the measure of the capacity of an alternating current generator just as horse power or kilowatt is the measure of the capacity of the engine or turbine driving the generator. Hence, if one considers the real size of the generator itself, he should rate it in kilovolt-amperes; if he considers the size of the prime mover and the actual energy output of the unit complete he should rate it in kilowatts. Under a certain ideal condition, the kilovolt-ampere output becomes identical with the kilowatt output. The conditions of operation met with in practice are seldom ideal but, on the other hand, are usually so adverse that the energy output is less than the electrical by many per cent. A generator operating with an output of only 100 k.w. in actual energy may be delivering current at a potential that would produce 120, 150 or 200k.w. if the conditions of load were more favorable. In fact, the internal work in the generator itself would be less if delivering 120, 150 or 200 k.w. under the better conditions. The factor that expresses the relation or ratio of kilowatts to kilovolt-amperes is the power-factor. Almost any good handbook, dictionary, text-book or elementary treatise on alternating current may be consulted on this subject under the terms "power-factor," "angle of lag," "apparent energy," "volt-ampere" or "kilovolt-ampere."—W. J. Foster, General Electric Co., Schenectady, N.Y.

DIESEL ENGINE TROUBLES.

WRITING on "Gas Power Topics" in the columns of the Power User, Mr. W. A. Tookey says that probably the most serious trouble that occurs in Diesel engine operation is the loss of compression pressure due to the wearing of the piston rings and of the cylinder wall. The reversal of the stresses between piston and cylinder that occur during the cycle of operations, due to the side thrusts caused by the angularity of the crank, is responsible for this wear, and it becomes essential to remove the piston, say, once in six months, for the renewal of the piston rings, or at least one or two of them.

When, after several years of work, it has been found, upon measurement, that the cylinder of an engine has become considerably "out of round" it will be recognized that this is an important matter which cannot be neglected. It is for this reason that those who have had experience in the running of Diesel engines would like to see it become common practice for trunk pistons to be abolished in favor of outside crossheads, as in steam engine practice, for then the side thrusts could be compensated for by proper attention being given adjustable slippers and guides, and undue wear of the cylinder and piston rings would be practically things of the past.

Canadian Association of Stationary Engineers' Convention

By B. G. Newton

While there is little doubt that the business side of the C.A.S.E. 24th Annual Convention at Owen Sound, Ont., does not suffer by comparison, there can only be, after a perusal of our representative's report which constitutes this article, added unanimity of opinion concerning the social side of the Convention, in that it eclipsed all such previous functions, and constituted a new high water mark to which Ottawa in 1914 will aspire to and attempt to cover.

THE best ever was the unanimous verdict of delegates and exhibitors regarding the twenty-fourth annual Convention of the Canadian Association of Stationary Engineers, held in Owen Sound, July 29-31. The weather, though warm, was well behaved, and perfectly suited to the occasion, and the citizens of Owen Sound did everything possible to make the Convention enjoyable.

Opening Ceremony.

The Convention was held in McLinden's Hall, a building both suitable and convenient. The exhibits were displayed on the ground floor, the business meetings and banquet taking place in the hall above. About 50 delegates, 25 visiting engineers and 30 supply men were in attendance. The Convention was opened on Tuesday, July 29th, at 1.30, by his Worship Mayor Lemon, who gave a most cordial welcome to both engineers and supply men. He expressed himself as always being pleased to welcome conventions of this character, and hoped that one or more of the supply houses would come to Owen Sound and start a branch manufacturing plant. His Worship invited those present to visit the industries of the town, making special mention of several. After announcing that Fire Chief Thompson would give a demonstration in the evening, and again voicing the pleasure of the citizens of Owen Sound in welcoming the delegates and visitors, the Convention was declared open.

Mr. J. A. Robertson, president of the C. A. S. E., in replying, thanked the Mayor for the hearty welcome extended. He had attended Conventions for a good many years, but Owen Sound's welcome beat them all. A few more bouquets were handed out ,and then Mr. A. Kastella, secretary, of Ottawa, was called upon. On behalf of the Exhibitors' Association, Mr. J. E. Fiddes reiterated the remarks of the previous speakers, and voiced his appreciation of the welcome extended. Adjournment was made till 3 o'clock. At the close of the meeting (1.30 o'clock) the visiting ladies were given an automobile ride.

Tuesday Evening.

At 7.30, Fire Chief Thompson gave an exhibition of quick work in getting to a fire, and at 8.30, the delegates, visitors and supply men were guests at a banquet given by Owen Sound Lodge No. 25, C. A. S. E. Caterer Douglas supplied the material needs of the occasion and handled the two hundred guests in splendid style. An excellent toast list was given, in addition to which Mr. William Taylor, president of the local Board of Trade also contributed.

W. A. Crockett gave an inspiring address on the accomplishments and aspirations, the work and the worries, the purpose and policy of the association. The other speakers gave addresses suitable to the occasion, while humor was at high pressure all evening. The musical numbers as well as the miscellaneous items on the list were highly appreciated, the supply men as usual being there with the goods and contributing, as a consequence, their quota.

Banquet Toast List.

THE KING:
God Save the King
CHAIRMAN'S ADDRESS:
Mr. Fred Harrison
Orchestra Selection
CITY OF OWEN SOUND:
Mayor Lemon
Highland Fling—Professor Leslie's Trio
THE ASSOCIATION:
Bro. W. A. Crockett.
Comic Song—Mr. Harry Lauder Brown.
CANADA:
Mr. W. S. Middlebro, M.P.
Recitation—Mr. W. S. Mann
OUR LEGISLATURE:
Mr. C. S. Cameron, M.P.P.
Violin Duet, Scotch—
Mr. John and Miss Nellie McKeen
OUR MANUFACTURERS:
Mr. James E. Keenan
Song—Mr. Horace Merry
Irish Jig—Miss Mary Leslie.
Orchestra Selection.
OUR EXHIBITORS:
Mr. J. E. Fiddes
Song, by Special Request—Mr. J. C. Armour
Sailor's Hornpipe—Master Robert Leslie
OUR GUESTS:
President W. E. Hooey
Instrumental Duet—Simns Brothers
THE LADIES:
Brother Wickens
Song—Mr. Harry Lauder Brown
Shewn Trews—Mr. Mc. Leslie
THE PRESS:
Mr. James Rutherford
Recitation—Mr. W. S. Mann
Song—Mr. F. F. Hetherington
"GOD SAVE THE KING."
McNiven's Orchestra
Mr. A. Quinn, Accompanist.

Wednesday Morning.

At 9 a.m. on Wednesday, July 30, a general business meeting was held, at which reports of committees were read and the election of the following executive officers of the C. A. S. E. for 1913-1914 took place.

C. A. S. E. 1913-1914 Executive.

Past President—J. A. Robertson, Stratford, Ont.

President—S. E. Cosford, London, Ont.

Vice-President—A. W. Heath, Hamilton, Ont.

Conductor—J. Dyson, Guelph, Ont.

Doorkeeper—W. E. Hooey, Owen Sound, Ont.

Secretary—A. Kastella, Ottawa, Ont.

Treasurer—W. E. Archer, Toronto, Ont.

Wednesday Afternoon.

On Wednesday, at two o'clock, the delegates and visitors attended a picnic in their honor provided by the supply men. Headed by the Salvation Army Band, the best in the town and a very fine musical organization, all marched down the main street to the wharf, where boats and launches were waiting to take the company to King's Royal Park, about four miles up the Sound.

The annual baseball game between the engineers and supply men headed the list of sports. The way the engineers walloped the leather around the lot was a shame. The following is the line up. It is too bad that we have to print the supply men's names, but the engineers' victory will seem all the more conspicuous when you see whom they were up against. The score was 6—8, the engineers winning:

Engineers' Baseball Team.

P.—Tait, London. Disabled by Wilkinson in warm up.

C.—Heath, Hamilton. Some catcher.

F.B.—Flood, Owen Sound. Could have used a chair, as he had little to do.

S.B.—Kastella, Ottawa. Strong on home runs.

T.B.—Mosley, Toronto. A fiend on catching out flies. Must have played on Toronto team last year.

S.S.—Cook, Belleville. Can run like a deer when he gets the chance.

R.F.—Tweedale, Toronto.

C.F.—Dad Wickens, Toronto.

L.F.—Mitchell, Stratford. Both fielders wore down the grass waiting for something to catch.

Supply Men Baseball Team.

P.—Bayer, Can. Allis-Chalmers.

C.—Crichton, Jas. Morrison & Co.

F.B.—Fisher, Can. Fairbanks-Morse.

NO. 1—GROUP OF SUPPLY MEN OUTSIDE McLINDEN'S HALL. NO. 2—ENGINEERS' BASEBALL TEAM. NO. 3—C. S. CAMERON, M.P.P., IN CENTRE; MISS CATHERINE CAMERON IN THE FOREGROUND; S. DEMILT, OF THE PEROLIN CO., ON THE LEFT. NO. 4—"DAD" WICKENS AND E. A. WILKINSOSN, OF THE LUNKENHIEMER CO. NO. 5—A "HOME RUN" BY KASTELLA; WALTHALL, OF QUAKER CITY RUBBER, ON THIRD BASE. NO. 6—THE SUFFRAGETTE RACE: BROWN, ENGINEER AT TORONTO JAIL, IN FOREGROUND ON THE RIGHT. NO. 7—SUPPLY MEN'S BASEBALL TEAM.

S.B.—Schragg, Can. Allis Chalmers.
T.B.—Walthall, Quaker City Rubber Co.
S.S.—Precious, Garlock Packing Co.
R.F.—Bickle, Can. Morehead.
C.F.—Charles, Can. Fairbanks Co.
L.F.—Archibald, McAvity.
Umpire—Ungerford, Toronto.

Sports Programme and Prizes.

The following was the programme of sports and prizes:

Baseball Match—Box of 100 cigars.

Suffragette Race—Ladies—1st, silver and cut cruet; men—1st, case of carvers.

Men's Race—100 yards—1st, silver cigarette case; 2nd, pocket knife.

Hobble Race—50 yards—1st, cut glass bon-bon dish; 2nd, pack cards.

Running Long Jump—1st, silver vase; 2nd, drinking glass.

Ladies' Race—1st, case of scissors; 2nd, silver picture frame.

Penny and Basket Competition—1st, cut glass vase; 2nd, pocket book.

Backward Race—1st, silver and glass butter dish; 2nd, pocket knife.

Fat Man's Race—1st, brass ash tray; 2nd, shaving brush.

Prize Distribution and Supper.

After a group photograph had been taken in front of the King's Royal Hotel, the sports prizes were distributed, Jack Armour, of "Power," New York, being the official in charge of the highly interesting ceremny. W. E. Hooey, hon. president of the Exhibitors' Association, was also presented with a handsome folding umbrella, and replied expressing appreciation of the honor done him. A rush was then made for the dining room of the King's Royal, where the hungry picnickers proceeded to clean up everything in sight.

After supper, a short programme was given in the rotunda of the hotel, which had been cleared for dancing. Mayor Lemon was chairman, and, after a brief address, called on Mr. Earl Hetherington for a song; on Jack Armour for anything that Jack Armour might be disposed to give, and on J. E. Fiddes for a song. After encores had been given, dancing commenced, and continued till 12 o'clock, when the steamer returned to Owen Sound. The weather was rather warm for dancing, but the breezes from the Georgian Bay helped a lot, and the afternoon was pronounced a big success.

Thursday morning was given over to the business of the C. A. S. E.

Exhibitors' Association Meeting.

A meeting of the Exhibitors was also held on Thursday morning, and consisted largely of the election of officers and the framing and distribution of votes of thanks. The minutes of the previous meeting were read and adopted.

A telegram from Ottawa Lodge, urging that the 1914 Convention be held in that city, was read, and a motion favoring the selection of Ottawa as place of next Convention, was moved by Mr. E. Wilkinson, seconded by Mr. E. Hetherington, and carried unanimously.

Moved by Mr. Wilkinson, seconded by Mr. Turner, that treasurer's report be printed and sent to each supply man. Carried.

That a vote of thanks to the local lodge and people of Owen Sound be given, and that same be published in local papers, was moved by Mr. Crichton, seconded by Mr. Keller, and carried.

Exhibitors' Association Officers.

President—E. A. Wilkinson, Lunkenheimer Co.

1st Vice-President—A. Pulver, Garlock Packing Co.

2nd Vice-President—B. M. Walthall, Quaker City Rubber Co.

Treasurer—B. G. Newton, "The Power House."

Secretary—G. C. Keith, "Canadian Manufacturer."

Assistant Secretary—Jas. Charles, Canadian Fairbanks-Morse Co.

Chairman of Exhibition Committee—E. Hetherington, Goldie & McCulloch Co.

Chairman of Entertainment Committee—C. P. Archibald, McAvity Co.

Chairman of Reception Committee—C. N. Schragg, Can. Allis-Chalmers.

Mr. J. E. Fiddes, the retiring president and hon. president for the ensuing year, spoke very highly of the work of all the officers, especially mentioning Messrs. Keith and Hetherington, and a vote of thanks was given these officers. Mr. Fiddes expressed a desire to encourage the feeling of friendly competition among the supply men, and to foster the spirit of co-operation which exists so strongly at present. The American exhibitors were welcomed, and a motion expressing pleasure at their presence was carried. The meeting then adjourned.

Exhibitors, Representatives, and Exhibits.

Canadian Allis-Chalmers — Working model of Squire's steam trap, Cochrane feed water heaters and barrow boilers.—C. N. Schragg and J. S. Boyer.

Dearborn Chemical Co.—Treatment of boiler feed water.—Jos. N. Gregory.

H. D. Edwards—Rainbow family, packings and gaskets.—J. S. Roblin and W. S. Roblin.

Turner & Tupper—Plastic fire lining and Meyer's automatic boiler cleaners.—C. B. Turner.

T. McAvity & Sons—Gaskets and valve discs.—C. P. Archibald.

E. Leonard & Sons—Engines and boilers.—W. F. Wheaton.

Canadian Fairbanks-Morse Co.—Steam specialties, valves, etc.—J. N. Charles.

Can. H. W. Johns-Manville Co.—Packings and cement specialties.—D. M. McKibbin.

Hugh C. MacLean Publishing Co.—Geo. S. Cook.

Garlock Packing Co.—Packings.—E. M. Precious.

Dart Union Co.—The Dart Line of Unions.—L. Archibald.

Standard Sanitary Mfg. Co.—Engineers' and marine supplies.—J. E. Fiddes.

Can. Morehead Mfg. Co.—Morehead system for boiler feed.—B. I. Bickle and J. McGochie.

Lunkenheimer Co.—Valves and fittings.—E. A. Wilkinson.

"Canadian Manufacturer"—G. C. Keith.

Jas. Morrison Mfg. Co.—General line of steam gauges, whistles, valves, stop cocks, pop valves, stationary or locomotive injectors, water gauges, gauge cocks, recording gauges, etc.—A. Betton and H. S. Crichton.

Goldie & McCulloch Co.—Engines, boilers, and general power plant equipment.—E. Hetherington.

Quaker City Rubber Co.—"P.P.P." and "Ebonite."—B. M. Walthall.

Perolin Co.—Showing Perolin the treatment for boiler scale.—S. Demilt.

"Power," N.Y.—Jack Armour.

"The Power House"—B. G. Newton.

The exhibits were all interesting, being closely inspected by the engineers and many of the local townspeople.

Exhibitors' Souvenirs.

Attractive and useful souvenirs, distributed by several of the exhibitors, were as follows:

Goldie & McCulloch Co.—Morocco card cases.

H. D. Edwards Co.—French briar pipes and leather coin purses.

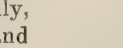
Dart Union Co.—Novel memo pad of fine quality leather.

Canadian Allis-Chalmers Co.—Morocco covered notebook, containing information re Squire's traps.

Canadian Morehead Co.—Engineer's hand book of useful information.

Garlock Packing Co.—Memo book.

Jas. Morrison Brass Mfg. Co.—Celluloid calendars and buttons.



"Waterworks of Canada" is the title of a publication issued by the Commission of Conservation, and compiled by Leo G. Denis, B.Sc. The book contains a brief description of the waterworks of each city and town in Canada, together with statistics of the principal physical and financial data respecting these public utilities.

THE OPERATORS' VIEWPOINT

Devoted to brief descriptive article contributions covering ideas and experiences pertaining to power plant practice and operation. We pay for accepted material.

KILOWATT AND KILOVOLT AMPERE.

By Geo. W. Richardson.

SOME engineers do not appreciate the difference between a k.w. (kilowatt) rating and one based at k.v.a. (kilovolt ampere). The frequent misuse of these terms clearly indicates that the distinction between them is not properly understood.

The term kilowatt (k.w.) is the measure of power which is all available for work, while the term kilovolt-ampere (k.v.a.) is the measure of electric power made up of two components—a wattless and a power component, k.v.a. measures apparent power, while k.w. measures real power. They are only identical when the power factor is unity—100%; that is to say, when the current and voltage are in phase. As far as power output is concerned, this is the best relation, as the whole output is then available for work. Under all other relations of electromotive force and current, the k.w. is less than the k.v.a. rating. This is true, regardless of whether the current leads or lags with respect to its electromotive force.

Wattmeter Function.

A wattmeter indicates the average product of the instantaneous values of electromotive force and current, while ammeters and voltmeters indicate the total current and voltage regardless of the power factor. The instantaneous values of electromotive force and current with loads at a power factor less than unity oppose each other at certain parts of the cycle, with the result that a wattmeter indicates the difference between the negative and positive powers, or that available for work. A wattmeter, therefore indicates only real power while the product of the ammeter and voltmeter reading multiplied by one for single phase, two for two phase and 1.73 for three phase circuits divided by 1,000, gives the apparent power in k.v.a.

The power factor is the k.w. as read on the wattmeter divided by the k.v.a. It is, therefore, obvious that the term k.w. should be used to designate true power which is all available for work. The term k.v.a. indicates that only part of the rating is available for work, this part being directly proportional to the power factor. The relation may be expressed mathematically as k.w.=k.v.a. p.f.

Power Factor Less Than Unity.

In making mention of a load which has a power factor less than unity, it is advisable to state the term k.w., power factor and k.v.a. thus 300 k.w., 80% p.f., 375 k.v.a. This indicates that the current in the circuit corresponds to 375 k.v.a. and heats the generator to this extent but that only 300 k.w. is available for work.

Another feature not fully understood by some engineers is the effect of a power factor (p.f) load on the generator. Standard generator guarantees are based on loads of 100% p.f., but it must not be inferred that a given generator will deliver its full rated output at all power factors. On loads of low power factor, it must be expected that the generator rating will be reduced in proportion to the power factor, and probably in a greater ratio if the power factor is very low.

Generally speaking a generator will carry a k.w. load to the extent of its nominal k.v.a. rating, if the power factor is not below 80%. The temperature guarantee on the field, however, must be increased 5 degrees C., while the actual power output must be reduced in proportion to the power factor. Any generator supplying a load may be considered as doing two kinds of work, internal and external. A certain amount of internal work ordinarily spoken of as losses (copper and iron) is necessary regardless of power factors.

It is usually considered that the wattless component of a current at low power factor is circulated without increase in mechanical input over that necessitated by the power component. This is wrong, because internal work or losses due to the extra current are produced, and must be supplied by the prime mover. Since these losses manifest themselves as heat, the capacity of the machine is reduced.

The External Work.

The external work is the power component and is all available for work. For example, let us consider that a 150 k.w. generator operating at unity p.f. at rated output of 150 k.w. absorbs internal work to the amount of 11 k.w., equal to the combined copper and iron losses. If it be operated with the same current and voltage, that is, 150 k.v.a., but at 80% p.f., it absorbs internal work amounting to 14 k.w., due to the increased field current made necessary by the demagnetizing action of the lagging armature current. This amounts to an increase of 60% field losses, the armature loss being unchanged, while the external work or real output is only 120 k.w.

If this generator were forced to deliver its rated mechanical load of 150 k.w. at 80% p.f., the k.v.a. output becomes 187½, and the internal work would increase to 17.8 k.w. comprising an increase of 56% in armature losses and 100% in field losses. This large increase in field current would be likely to dangerously heat the field winding. Moreover, the increase in field current necessary to maintain the voltage would severely affect the regulation, and, therefore, the lagging current of the load should be kept at a minimum.—Popular Engineer.

BABBITTING EXPERIENCE.

By Jas. E. McCormack.

LAST season I had a couple of solid bearings to re-babbitt, and had no cores of the proper size at hand. I had once seen the same shaft lined-up in position bare, and babbitted as it was; then a couple of hours were spent pounding the bearings off, and removing with a half round file enough of the metal to allow the shaft to revolve freely.

Detail of Method Adopted.

I decided to try some other method, and after unbolting the bearings, I blocked the shaft up, slid the bearings off, and, of course, removed all the old babbitt. I then cut a strip of paper a little wider than the bearings were long, and put two laps of this around the shaft at each bearing; cementing the edges down tight, and turning the shaft to put these cemented edges underneath, so that the flowing metal would not loosen up the joint and spoil the run. To make doubly sure that the paper would keep its place, I wrapped it with small cord. Starting just inside one edge of the bearing surface with the centre of the string, I made one straight lap around the shaft, then wound spirally to near the other edge of the bearing by lapping with both ends simultaneously, finishing with one straight lap and tying the ends together. When this was done, I had made about one lap with each hand for every inch the bearing was long.

In addition to holding the paper in place, this formed oil grooves in the metal to assist in lubrication, care being taken that the cord used was not so coarse as to make the grooves deep enough to materially weaken the lining, and also that the grooves did not extend to the outside edge of the bearing, and thus afford a spillway for the lubricant to waste

After the pouring was finished, a lever passed through the spokes of the pulley forced the shaft to turn, and after the second revolution made in this manner, the holding bolts were removed, and the bearings pulled off by hand. The paper and as much cord as would come were taken out, and the bearings replaced. The latter have given entire satisfaction, and the work was accomplished in much less time and with less labor than would have been required to loosen them with a sledge and ease them with a file if the paper had not been used. When oil is the lubricant applied, a finer cord should be used than if the lubricant is to be cup grease.

Another Example.

In another machine there was a bearing which had given trouble from the first day it was operated, this trouble being caused by the designer attempting to make two bearings do the duty of three. There should have been a pedestal alongside of the machine, with a third bearing to carry part of the strain of the belt, but the arbor was made too short to allow of this, thereby throwing upon this troublesome bearing an excessive pressure and friction.

The arbor was 2 7-16 in. diameter, and ran 1,800 revolutions per minute in bearings six inches long. I finally secured a cool running bearing as follows: I began by digging out all the babbitt, and chiselling in the bottom of the bearing a chamber about 7/8 in. wide, 5/8 in. deep, 3½ in. long on the bottom and 5 inches long at the top, the ends sloping up gradually to a point. I next cut a stick to fit this chamber and come even with the top of the iron, but afterwards whittled it on the two sides to bring it to ½ in. wide instead of 7/8 in., and with a cord I bound this to the under side of the arbor and directly over the chamber, having first carefully wrapped the arbor with two thicknesses of paper and cemented the edges down.

With pieces of old babbitt I blocked the arbor in position, puttied and poured the bottom half of the bearing, then bolted the cap in place with liners inserted, and puttied and poured it also. When cool I removed the cap, raised the arbor, took out the cord, stick, and paper, smoothed up the reservoir (where the stick had been), eased off the edges of the bearing, bored out the grease cup hole, cleaned the parts, filled the reservoir with cup grease, and re-assembled the parts. I next filled the grease cup, and, after forcing some of the grease through onto the arbor, I started the machine. The bearing did not heat, and it has not given any trouble since, nor has it required any more than one-third the amount of lubricant that was formerly necessary.

As the reservoir itself was seamless, and as the arbor had been blocked in position with pieces of babbitt, and the new pouring had flowed around this perfectly, there was no chance for lubricant to waste by oozing through the babbitt, and out between it and the frame of the machine. The grooves left in the metal by the string formed passage ways for the lubricant to reach every part of the journal.

A little resin in the babbitt causes it to flow better, and is good to use when doing babbitting in an unheated building in winter weather. Asbestos mixed with cylinder oil makes an excellent substitute for putty when babbitting, and it has the advantage that it will keep for months, ready for use, and does not get hot like putty.

CONVENTION NOTES.

By Onlooker.

IT looked like an "Old Boys'" reunion.

Owen Sound knows how to welcome.

Owen Sound is a dry town. Supply men were, however, on hand.

W. S. Middlebro, M.P., didn't know what C. A. S. E. meant. It reminded him of a story where C. A. S E. in code meant Come Around Sunday Evening.

Dad Wickens, father of the C. A. S. E., was on hand again, but Mrs. Wickens for the first time in many years was unable to attend.

August Kastella is pretty level-headed, but he had a hard job landing second prize in the penny and basket competition.

Dad Wickens is seventy-two years old, but he can swat a ball and chase a base like a big leaguer just getting back in the game. We tried to get a snapshot of him in action, but he was too fast for our camera.

Convention Hall was decorated with bunting, flowers, palms and **Power Plants.**

McLinden's black kitten was a good mascot.

The rapid increase in the consumption of pipe tobacco is largely due to the liberal distribution of Roblin's Peerless Packing Curly Pipes.

The Sydenham Club entertained the executive of the C. A. S. E. and the supply men, and were hospitality itself.

Mr. McLinden was unsparing in his good will, and was particularly solicitous about the comfort of the supply men. The latter passed round the hat and presented Mr. McLinden with a little token of their appreciation.

As director of sports, C. P. Archibald has few equals; as a favorite with the ladies, he has none.

The people of Owen Sound know two things at least: They know a good thing when they see it, and they know how to show their appreciation of it.

The chief of police said, "Boys, the city is yours, but don't take it away with you."

Packing up the exhibits was a real hot job. Wilkinson sweat real perspiration over his. Bickle lost 15 pounds crating his, and Betton and Crichton seemed to have two days ahead of them when the majority said "Good-bye."

Brother Cook, of Belleville, said that the Owen Sound Convention was nearly as good as last year's at Belleville.

Mayor Lemon—We have locked up the police; the town is yours.

When it comes to telling stories, few have it on Caterer Douglas.

Brother Crockett informed us that much real work was done, and that several problems had been solved, or would soon find solution.

The Convention Souvenir Booklet was the most pretentious yet issued, and much credit is due the men responsible for its production. What's the matter with Snowball?

Mayor Lemon, Mrs. Lemon, Mr. and Mrs. Cameron and daughter attended the picnic at King's Royal Park.

Nearly all the old guard of the supply men were on hand. Pulver, of the Garlock Packing Co.; Heintzman, of the Peerless Rubber Co., and Tyrrell, of "The Power House," were missing.

The local sign painter hopes the Convention will meet in Owen Sound again soon, and that all the supply men will need display signs. He did a big business on opening day, and made about a dozen very attractive canvas signs.

Ottawa, 1914—Hamilton, 1915.

Many ladies inspected the exhibits, and greatly admired the floral decorations, the gold fish and the men in charge, the latter particularly.

In the suffragette race .Mrs. Brown refused to move from the starting line and won the event. If it had been Mr. Brown instead of Mr. Tweedale the result would have been entirely different.

MOTOR BREAKDOWN.

By A. F. Adams.

ON Tuesday, June 24, of this year, during a severe electrical storm, which passed over the city of Vancouver, the 400 h.p. 3-phase alternating current, induction motor, in the plant of the Vancouver Ice and Cold Storage Co., which drives a 130-ton ammonia compressor, stopped after a particularly heavy peal of thunder.

When the machine stopped, the no-voltage circuit breaker went out, at the same time throwing oil out of the circuit breaker box. Smoke also was noticed around the motor, but apparently it came from the breaker box. On investigation, the fuses and all parts of the motor seemed to be uninjured, and as soon as the city turned power on the line from which we were feeding, it having been temporarily shut off, the motor was started and ran for 26 hours, showing no signs of trouble.

Development of Trouble.

We had to shut down for a couple of days while the compressor rod was being turned and the valves were being overhauled. This work being completed, the compressor was again started, but had hardly attained full speed when the insulator on the armature coils of the motor gave way in a number of places.

The rotor was left in its natural position, being held by the end bearing, while the centre bearing was slung up. The armature, including the frame, was moved straight out from the rotor on to a platform built for the purpose, after which men were at once put to work to repair the broken insulation.

Trouble Again in Evidence.

On July 3, the motor was again started up, when the insulation gave way at several more places. These having been repaired, the motor gave no further trouble. The motor is of 400 h.p., 2,200 volts, 117 amperes per terminal, 3-phase, 60 cycles, 285 r.p.m., full load speed, and was built by the Canadian Westinghouse Co., Hamilton, Ont.

Query I.

Did the lightning puncture the insulation? If so, why did the motor not show signs of trouble when it was first started after the storm?

Query II.

If lightning was the cause of the trouble, is there not some way of protecting the motor and making it safe to operate during an electrical storm?

READER, WHAT DO YOU KNOW?

Among readers of The Power House there is a clearly defined sincerity of desire to know how each overcomes the daily problems arising out of the care and operation of the power plant. It is believed that your methods of solving these are valuable, and can be made more so, if you publish them, so that other brains may help in the work. We will provide the setting and pay you for the material. When your fellow engineer puts the super-structure on your foundation, we pay him and pass the "kink" on to you, free. Get into the game.

The motor, which is loaded only to about half its rated capacity, has been in operation two years, and has never previously given a minute's trouble.

PRESERVING THE POLISH OF TOOLS.

By J. Crow Taylor.

CONDENSATION of moisture on the surface is what takes the polish off tools and makes iron rust. Preventing it is simply a matter of keeping the surface coated with some varnish, resinous or oil substance. If tools are carefully cleaned every night, and then gone over with an oily rag, they should keep in very good shape; that is, if they are in use every day so that the oily coating has a frequent renewing. A heavier coating for tools that are to be put away for some time, and one that can be cleaned off readily, can be made by melting together 7 parts of tallow and 1 of resin, stirring the same till it cools. Apply in a half liquid state, thinning to the right consistency with either benzine, gasoline or coal oil.

THE ENGINEER LOOKING FOR A POSITION.

By J. E. N.

HOW many engineers have applied for a position at some plant where there was a vacancy on the staff, and for no reason they could figure out the application would be turned down. Perhaps they had good records, and No. 1 recommendations, but it was no go. There are several things an engineer should attend to if he desires to secure a favorable hearing, and a few hints to some of the boys may be helpful.

Serviceable Hints.

I remember reading what a prominent business man said about this matter. Said he: "If I only had a few dollars I would spend them on a neat outfit of clothes (unless I already had them) and get a clean shave, a hair cut and a general brush up before applying for a situation, for it is a mistake to imagine that any careful business man will employ a slouchy applicant." Most employers will carefully overlook a prospective employee, examine his clothes, speech and manner. If you hesitate in your answers to his questions, he will probably conclude you are without confidence in your own ability; therefore, show by appearance and manner that you have some pride, intelligence and confidence in yourself, but be careful not to be too independent as to become impertinent.

Do not ask the prospective employer's pardon for intruding upon his valuable time, or even for being so thoughtless as to be on the earth, but be courteous and straightforward without being servile.

It is a good idea to go looking for the position with the determination of making the employer certain that he needs you. Tell him that you want the opportunity to show him that you can save him money, and if you cannot do so you will cheerfully get out. It is well to remember that no one wishes to employ a failure, so do not be listless, dopey or despondent in your manner, no matter how you feel, but brace up, put on a cheerful face, and ask for the position like a man. If you are too late, ask him if he knows where a good man can get a place, and the chances are that he will put himself to some trouble to help you out if you impress him right.

Do not keep your overalls on when you go applying for a situation, thereby expecting to impress folks with the idea that you are a worker, because probably the man you wish to impress will put you down in his mind as being too lazy to clean yourself properly.

PROGRESS IN NEW EQUIPMENT

There is here provided in compact form a monthly compendium of the power plant manufacturers' achievements.

THE WHEELER TURBO AIR PUMP

A CENTRIFUGAL pump discharging into an ejector, will remove air and vapors from a condenser and will maintain a high vacuum, provided sufficient water at a high enough head is discharged into the ejector. The air entraining capacity of an ejector is however, limited, so that such air removing apparatus would be costly and wasteful of power and would be unable to meet overloads due to excessive air leakage. A method of increasing air handling is to cause the water to discharge intermittently into the ejector nozzle so that it entraps air between successive discharges, as well as entraining it on its surface. A pump constructed on this principle has recently come into use both here and abroad.

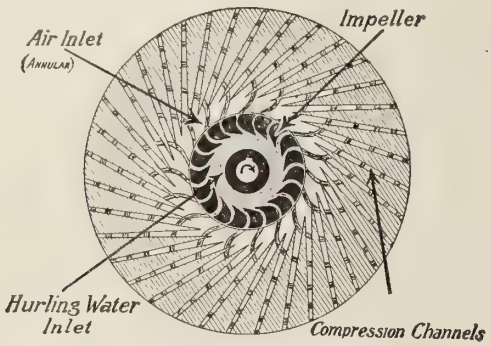


FIG. 1. DIAGRAMATICAL SECTIONAL VIEW SHOWING PRINCIPLE OF AIR REMOVAL.

The Wheeler turbo air pump has been developed along somewhat different lines, being based on the designs of the German pump built by the A.E.G., and manufactured by the Wheeler Condenser & Engineering Co., Carteret, N.J. An apparent difference in design is the entire absence of the external ejector nozzle.

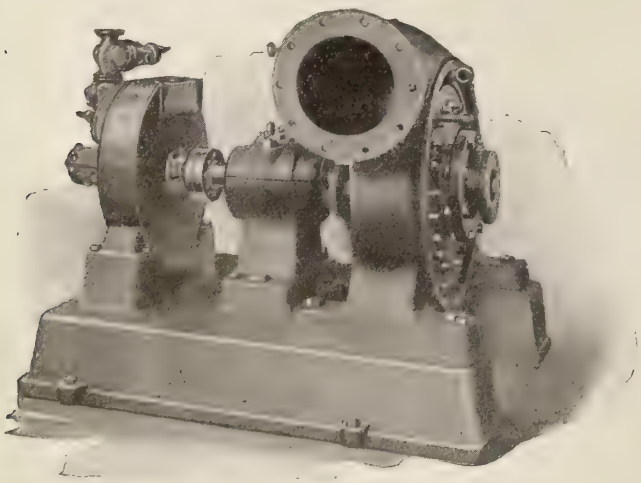


FIG. 2. COMBINED CONDENSATE AND TURBO AIR PUMP, DRIVEN BY STEAM TURBINE.

In general appearance, the air pump is similar to a centrifugal pump. It is driven at high speed by either a motor or turbine. The pump, shown diagramatically in Fig. 1, consists of a small high speed impeller with a large number of ports or nozzles on its periphery; of a ring of tapered compression channels, and of a discharge casing or volute not shown. Water enters the eye of the impeller as in an ordinary side suction centrifugal pump, and is impelled at high velocity through the ports in the impeller which rotates in the opposite direction to the impeller of a centrifugal pump. Air is admitted around the entire periphery of the impeller, and is drawn into the entrance of the tapered compression channels by the aspirating effect of the rapidly discharged water. As the slugs of water move outward,

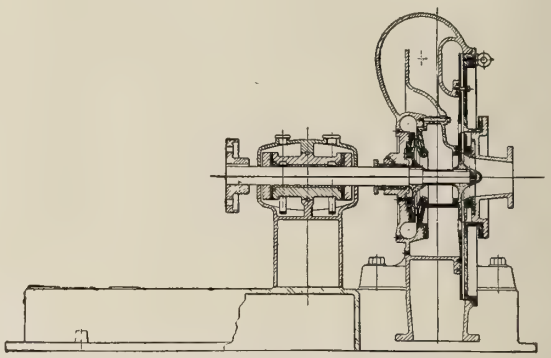


FIG. 3. CROSS SECTION OF COMBINED TURBO AIR PUMP AND CONDENSATE PUMP.

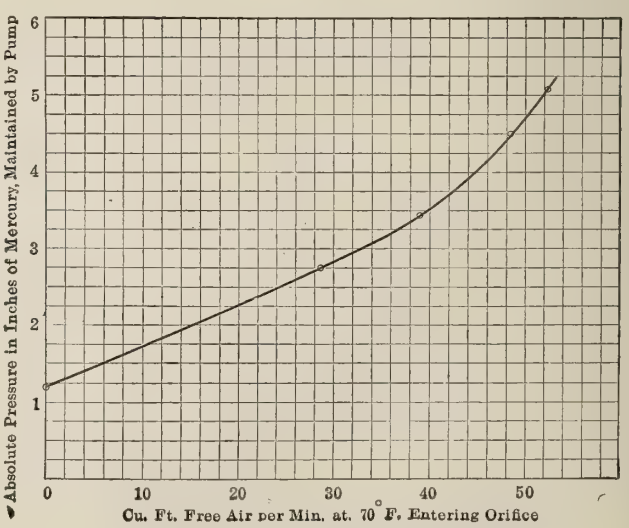


FIG. 4. RELATION OF AIR CAPACITY IN CUBIC FEET OF FREE AIR TO ABSOLUTE PRESSURE MAINTAINED.

they become elongated owing to the tapering of the channels, the space between slugs decreases and the air entrapped is compressed. The mixture of air and water is discharged from the tapered channels into a volute casing, somewhat similar to that of a centrifugal pump, and is finally discharged through a suitable outlet nozzle.

These pumps are adapted for both jet and surface condensers. For the latter service, the turbo air pump is frequently combined within a common casing with the condensate pump, thus securing many obvious advantages. The photograph, Fig. 2, and the drawing Fig. 3, illustrate a combined pump of this type. Air and condensate are withdrawn from the surface condenser through a common pipe, flowing to a common suction nozzle on the pump. Just within the nozzle is a partition which separates air and water, the latter flowing by gravity to the eye of the condensate impeller, which is of the ordinary centrifugal pump design, while the air and gases flow over the partition wall, direct to the annular air inlet surrounding the hurling water impeller of the air pump. Within the single casting,, two volutes are formed, one for condensate, the other for hurling water and air, so that as far as operation is concerned, the two pumps are entirely independent. However, a distinct saving results from the fact that the amount of piping between condenser and pump is reduced and simplified. The space ordinarily required by the two pumps for air and condensate is also greatly reduced, and both pumps are driven on a single shaft by a common turbine, thus saving power.

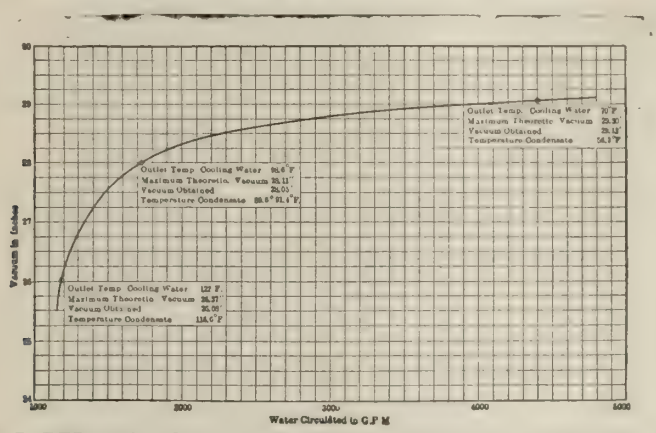

Outlet Temp. Cooling Water 70° F.
Maximum Theoretic Vacuum 29.3"
Vacuum Obtained 29.13"
Temperature Condensate 54.1° F.
Outlet Temp. Cooling Water 98.6° F.
Maximum Theoretic Vacuum 28.11"
Vacuum Obtained 28.0"
Temperature Condensate 88.6° 91.4° F.
Outlet Temp. Cooling Water 122° F.
Maximum Theoretic Vacuum 26.57"
Vacuum Obtained 26.00"
Temperature Condensate 114.6° F
Vacuum in Inches
Water Circulated in G.P.M.

FIG. 5. RELATION OF VACUUM MAINTAINED IN CONDENSER AND QUANTITY OF CIRCULATING WATER IN G.P.M.

Performance and Characteristics.

Pumps of this type will maintain a vacuum of 98-99 per cent. of theoretical, that is within a very small fraction of an inch of the vacuum corresponding to the temperature of the hurling or throwing water. This is not only true for low temperatures of water from 32 degs. to 60 degs., but also for hurling water at temperatures of 70, 80 and 90 degs., and higher, as encountered in the summer months, and in cooling tower work. The curve, Fig. 4 shows the air capacity in cubic feet of free air at 70 degs. F., plotted against the inches absolute pressure maintained by a recent pump. The hurling or throwing water temperature was 78 degs. F., which corresponds to a vacuum pressure of 96 inches of mercury, which is to be compared with the maximum vacuum obtained by the pump of 1.1 inches absolute pressure.

An important characteristic of this pump as demonstrated by this curve is the large free air handling capacity, and its ability to withstand overloads. This follows from the fact that there is a positive aspirating effect at the entrance of the numerous tapered compression channels, into which air must be drawn so long as the impeller rotates and discharges water. Accordingly, we find that increase in load or the cubic feet of free air handled, does not cause failure of the pump but simply a fall in vacuum not unsimilar to the characteristic of a displacement type pump.

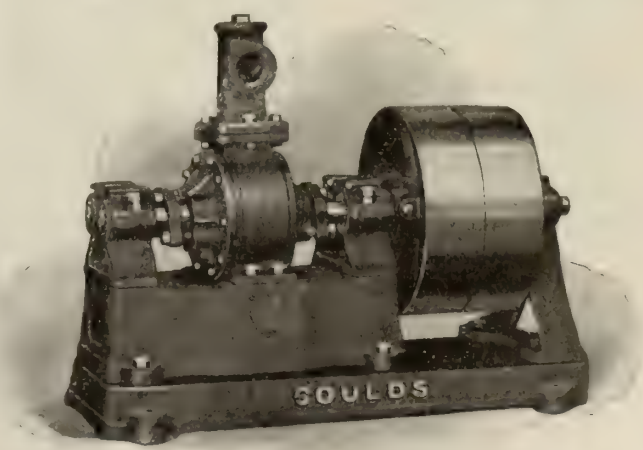
The operating importance of this point is that if the air leakage on a condenser be increased at any time, due, for instance, to failure of the turbine seals, the pump will not refuse to handle the added load with a resulting b·eak in vacuum, but will maintain a moderate vacuum until the air leakage trouble has been corrected. A common experience with ejector air pumps is a failure of the vacuum due to a transient increase in air leakage.

Fig. 5 shows the relation between vacuum maintained by a surface condenser equipped with a turbo air pump of this type and the amount of condenser circulating water in g.p.m. The vacuum maintained and outlet circulating water temperatures are given for a number of points on the chart; for instance, with 4,400 gallons of water per minute, the vacuum maintained was 29.13 with outlet cooling water at 70 degs., which corresponds to a maximum theoretical vacuum of 29.30; that is, .17 inch higher than the actual vacuum maintained. Similarly with 1,720 gallons of water per minute, the vacuum maintained was 28 inches, and the outlet cooling water temperature 98.6, corresponding to a maximum theoretical vacuum of 28.11 inches.

Besides indicating the excellent performance of turbo air pumps of this design in connection with surface condensers, this chart is of additional interest in that it shows the increase in cooling water necessary to obtain very high vacuum. The temperature of the inlet cooling water was about 50 degs. To maintain a 29.1 inch vacuum, it was necessary to use almost four times as much water as that for a 26-inch vacuum, and 2½ times as much water as for a 28-inch vacuum.

NEW ROTARY POWER PUMP.

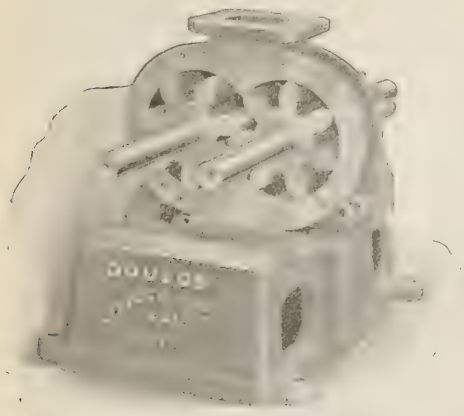
A NEW type of Rotary Power Pump has just been developed by the Goulds Mfg. Co., Seneca Falls, N.Y. This pump differs from the rest of the lines of pumps of the same capacity, in that gear style cams have been substituted for the three-toed cams used in



NEW ROTARY POWER PUMP.

the remainder of the line shown by one of the illustrations, and the gears on the end of the cam shafts have been eliminated.

Two sizes are built:—No. 1 has a capacity of 25 to 50 gallons per minute at 225 to 450 revolutions, and No. 2 has a



NEW ROTARY POWER PUMP.

capacity of 50 to 100 gallons per minute at 225 to 450 revolutions. Both pumps are suitable for pressures up to 100 pounds or 230 feet elevation. They are mounted on a cast iron bed plate, fitted with an outboard bearing, and tight and loose pulleys for belt drive. The suction connection is made within the base directly beneath the case, and is reached through hand holes in the base. No. 1 has two discharge openings, one tapped for pipe and the other threaded for hose couplings. No. 2 has three discharge openings, two fitted the same as No. 1, and the third fitted with an interchangeable blank flange. The suction is 3 inches on No. 1, and 4 inches on No. 2, while the discharges are for 1½ and 2 inch pipe or hose respectively.

The Goulds line of pumps are for sale in Canada by The Canadian Fairbanks-Morse Co. Ltd.

NEW WESTINGHOUSE SINGLE-PHASE MOTOR.

THE Westinghouse Electric & Mfg. Co. has placed on the market a new line of single-phase motors, made in capacities of from 2 to 10 horsepower, and suitable for the majority of constant speed applications within their capacities. The motor is of the repulsion-starting type, and when up to speed, runs as an induction motor. For most applications, it can be connected directly to the line, but where very low starting current is desired, a starting rheostat can be used.

The frame is so designed that it combines great strength and radiating capacity with minimum weight and over-all dimensions. The laminations are riveted together under pressure, and pressed steel end plates are riveted to the unit thus formed. The foot, or base, is of pressed steel plate securely riveted to the end plates. This use of pressed steel marks an important step forward in the design of large single-phase motors. The bearings are large and dust-proof. The rotor coils are form-wound, and arranged to permit excellent ventilation. The commutator is of the radial type with undercut mica segments, and the shaft can be pressed out of the rotor without disturbing the windings or the commutator. Each motor can be arranged for operation on either 110 or 220 volt circuits.

REFRIGERATION EQUIPMENT.

Prince Rupert, B.C.—The Atlin Fisheries Co., Ltd., contemplate building a cold storage and fish freezing plant.

Vancouver, B.C.—The Duscheny Packing Co., will erect a factory at Ladner, B.C., for drying and packing fruits and vegetables by a special process.

Toronto, Ont.—The Midmaples Apartments has been equipped with a 2-ton refrigerating machine, supplied by the York Manufacturing Co., York, Pa.

Vancouver, B.C.—The British Columbia Fisheries, Ltd., is preparing to build a large fish freezing and cold storage plant in the northern part of the Province.

Toronto, Ont.—Joseph Kilgour, proprietor of Sunnybrook Farm, near Toronto, who is building a large residence, contemplates installing a refrigerating plant.

Toronto, Ont.—The Dominion Brewing Co. has installed a 40-ton refrigerating machine and high pressure side complete, furnished by the York Manufacturing Co., York, Pa.

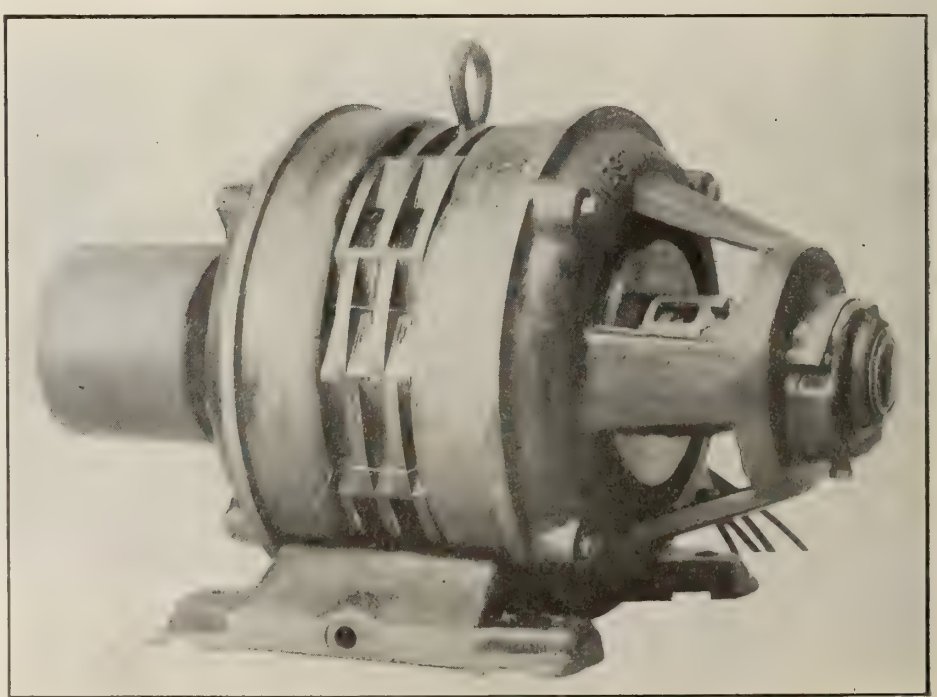
Toronto, Ont.—The T. Eaton Co., have added to the equipmemnt in their department store one 8-ton and one 11-ton vertical refrigerating machine, furnished by the York Manufacturing Co., York, Pa.

King, Ont.—Sir Henry Pellatt, proprietor of the Pellatt Farm, has installed at his residence a 4-ton single-acting, belt driven refrigerating machine, furnished by the York Manufacturing Co., York, Pa.

Vancouver, B.C.—The British Columbia Fisheries, Ltd., are erecting at Alford Bay, Queen Charlotte Islands, a 10-ton refrigerating and ice-making plant furnished by the Vulcan Iron Works, San Francisco, Cal.

Port Hawkesbury, N.S.—The North Atlantic Fisheries are having their fish freezing and cold storage warehouse equipped with two 125-ton refrigerating machines, contract for which was let to the York Manufacturing Co., York, Pa.

Calgary, Alta.—The new packing house being erected by P. Burns & Co., will be equipped with a 250-ton refrigerating plant, contract for which, including condensers, piping, etc., has been let to the Ice & Cold Machine Co., St. Louis, Mo.



NEW WESTINGHOUSE SINGLE PHASE MOTOR.

SIEMENS BROS. DYNAMO WORKS | SIEMENS BROS. & CO.

SIEMENS

SIEMENS - SCHUCKERTWERKE | SIEMENS & HALSKE

SIEMENS

Siemens 750 K.W. Direct Current 550 Volt Generator Supplied to the City of Edmonton.

Amongst other generators supplied or on order for Canada, the following may be mentioned:—

1—4,000 K.W. Edmonton.	1—800 K.W. Canadian Collieries.	2—500 K.W. Winnipeg.
1—2,500 K.W. Dominion Coal Co.	1—800 K.W. Dominion Coal Co.	2—500 K.W. Port Arthur.
1—2,000 K.W. Edmonton.	2—750 K.W. Medicine Hat.	2—500 K.W. N.S. Steel & Coal Co.
3—2,000 K.W. Dawson City	1—750 K.W. Edmonton.	2—400 K.W. Regina.
2—1,500 K.W. Regina.	1—750 K.W. N.S. Steel & Coal Co.	1—400 K.W. Lethbridge.
1—1,500 K.W. Lethbridge.	1—700 K.W. Canadian Collieries.	1—400 K.W. Yorkton.

The Siemens Company undertakes the complete equipment of electrical plant of every description and substations up to 110,000 volts.

Siemens Company of Canada, Limited

HEAD OFFICE:

Transportation Building - MONTREAL

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STANDARD BANK BUILDING
TORONTO

McARTHUR BUILDING
WINNIPEG

The advertiser would like to know where you saw his advertisement—tell him.

POWER PLANT DEVELOPMENTS

A record of current municipal, manufacturing and general industrial projects, involving steam, gas, oil, electricity, air and water power equipment requirements.

Electrical

Russell, Man.—S. D. Sparrow is the general contractor for an $18,000 electric light plant to be installed here.

Montreal, Que.—A fire in the main office of the Bell Telephone Co., July 30th, put 7,000 main telephones out of business.

St. Catharines, Ont.—On August 28 the ratepayers of St. Catharines will vote upon the question of taking a supply of Hydro-Electric power.

Medicine Hat, Alta.—City Engineer Grimmer has been authorized to place an order for six 500-kilowatt transformers. A total voltage of 13,000 will be installed.

Grenfell, Sask.—The citizens have adopted a by-law to raise $15,000 for installing a civic electric plant. The contract has been let and it is hoped to have the plant in operation by Oct. 1.

Galt, Ont.—On the suggestion of Dr. W. S. Dakin, Chairman of the local Hydro-electric Commission, the City Council will consider the purchase of a pulmotor, the cost to be shared by the town and the Hydro Commission.

Regina, Sask.—The experimental station at Estevan which is being established by the Provincial Government will be finished this month, and it will then be possible to complete the investigation into the power-producing possibilities of Estevan coal.

Vancouver, B.C.—At a meeting of the Ratepayers' Central Executive on July 21 consideration was given a campaign for the establishment of a municipal electric light and power plant. Kerrisdale Association has asked that the scheme be enlarged to include the neighboring municipalities.

Toronto, Ont.—The Hydro-Electric Commission of Ontario have decided to enlarge the power house at Niagara Falls, and to double the line between Dundas and the Falls. This will provide the necessary current for the line between London and Dundas, towers for which are already erected. The work will cost $300,000.

Orillia, Ont.—An agreement has been reached between the Minister of Railways and Canals and the members of the Orillia Water, Light and Power Commission, under which the department undertakes to build a new dam and power house, a mile and a half below the town's present plant on Ragged Rapids. This will cost the Government $112,000. The town will provide the new machinery for 3,500 h.p., the cost of which is estimated at $70,000.

Hydro-Electric Power.—Cannington, Beaverton, and other municipalities in this district will have Hydro power in their factories soon. The Provincial Commission has awarded the switching and transformer equipment contract to the Westinghouse Co., and the contract for supplying generators to the European house of the Kilmer-Pullen Co. The power will be obtained from Wasdell Falls, North Orillia township, Simcoe County, and Galbraith & Co., of Montreal, are constructing the necessary dam.

Welland, Ont.—A new transformer house for the Hydro-Electric will be erected on Queen Street. This is required for the increased load used by the Canada Forge Works. It will be fed direct from the new line from Niagara Falls and will be in operation before the snow flies. The new line from Niagara Falls direct to Welland is now being built and a primary line is being built to Turnbull's brick yard, where electricity is being installed instead of gas, and the machinery will be operated by electric power. The brick will also be dried by electricity. Negotiations are now on for a contract for 6,000 horse-power for the new electric smelter to be erected on the site of the brick yard.

Water Works

Halifax, N.S.—The city is borrowing $300,000, among other things for sewer construction, costing $152,500, and extension of water system, costing $50,000.

Edmonton, Alta.—By-laws to authorize debentures for municipal expenditures of $2,340,400 have passed their final reading. These include $519,760 for waterworks, and $1,692,149 for sewer extensions.

Toronto, Ont.—Allen Hazen, of Hazen & Whipple, New York, will probably design the city's new million-dollar mechanical water filtration plant to be constructed on Toronto Island. Toronto cannot engage anyone else if it wants to, according to an agreement entered into with Mr. Hazen on August 8, 1912, when the municipality agreed with Mr. Hazen that he should be retained to give expert advice in connection with the construction of future extensions of the filtration plant. Mr. Hazen has written to the city reminding them of the agreement and intimating that he expects to have charge of the plans for the new plant the City Council voted recently to construct.

Trade Gossip

Capital Increased.—The capital of The Barcelona Traction Light & Power Co. Ltd., has been increased from $30,000,000 to $42,500,000. The capital of the Standard Iron Co. Ltd. has been increased from $100,000 to $300,000.

Boving & Co., of Canada, Ltd., who recently acquired works at Lindsay, Ont., for manufacturing high-class hydraulic machinery, have been awarded the contract for large turbines and governors by the Hydro-Electric Power Commission of Ontario for the Wasdells Falls on the Severn River. These units will be of similar size to those recently supplied by Boving & Co., of Canada, for Dams Nos. 2 and 5, in the Trent River, which have a combined capacity of 10,000 horse-power.

The Canadian Griscom-Russell Co., Ltd., has established a well appointed machine shop and sales office at 736 St.

"Cyclone" with Norivet Head

Your Fuel Bills

need close watching. If they are more than they have been in the past, there is a reason.

When you investigate the cause, you will probably find it due to Boiler Scale.

A Liberty Tube Cleaner will quickly remove the **cause**, and your fuel bills will soon show the **effect.** A saving of even 10 per cent. as well as the additional security against accidents will amply repay the cost of the Cleaner.

Liberty Cleaners are thorough, speedy and economical, and are adapted to all types of boilers and for light or heavy scale.

Ask your neighbor who is using a **Liberty** what he thinks of them.

Write for Catalog.

Liberty Manufacturing Company

6904 Susquehanna Street **PITTSBURGH, PA.**

Canadian Representatives:
Williams & Wilson, Ltd., Montreal. A. R. Williams Machinery Co., Toronto and Winnipeg.

"TWINS" EXCITE ADMIRATION

Because They Earn It

Think of a TWIN when you hear the word STRAINER

The installation of a Twin Strainer on your water supply line eliminates troubles, worry, waste of time and expense—because

It has two straining baskets—that may be cleaned alternately, thus permitting continuous operation.

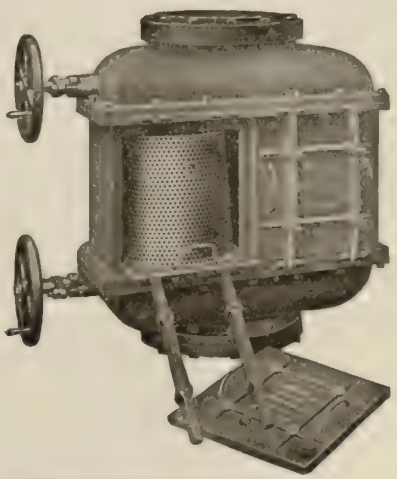
It has but two valves—they are of the gate type and are always tight.

It gives a direct flow with minimum friction loss, insuring easy operation with no waste of energy.

In fact, a Twin Strainer is an insurance policy in active service.

Designed to protect and built to last.

Write for our bulletin.



THE TWIN STRAINER.

ELLIOTT COMPANY

6902 Susquehanna Street, **PITTSBURGH, PA.**

Manufacturers of Filters and Grease Extractors, Separators, Blow-off Valves, Feed Water Heaters and General Power Accessories.

CANADIAN REPRESENTATIVES:
Willams & Wilson, Ltd., Montreal. A. R. Williams Machinery Co., Ltd., Toronto and Winipeg.

The advertiser would like to know where you saw his advertisement—tell him.

Paul street, Montreal. Here they will manufacture for the Canadian market the various specialties of the Griscom-Russell Co., of New York City. These include steam power plant accessories, distillation plants, refuse destructors, etc. The company also manufacture a complete line of feed water heaters, steam and oil separators, etc. Mr. W. H. Ripley is general manager of the Canadian Company, who have already supplied sets of distillation apparatus to the Ice Manufacturing Co., Montreal and to the Artificial Ice Mfg. Co., Ottawa.

Working Model Squire's Trap.—The exhibit of the Canadian Allis-Chalmers, Ltd., at the Convention of the Canadian Association of Stationary Engineers, held at Owen Sound, Ont., recently, included a perfect working model of a ⅜-inch size Squire's trap. Water was supplied to it by a small centrifugal pump driven by an electrical motor, and a great deal of interest was taken in its operation. This exhibit was supplemented by very interesting literature covering the new type Barrow combination fire and water tube boiler, and also literature covering Cochrane feed water heaters and steam specialties. The exhibit was in charge of C. N. Schrag, assisted by J. G. Boyer.

Laurie & Lamb, Board of Trade Building, Montreal, have secured an order for three Bellis & Morcom engines for the new plant of the Atlantic Sugar Refinery Co., Ltd., St. John, N.B. These engines will each develop 450 h.p., and will be of the two-crank compound non-condensing type. Laurie & Lamb have also secured the contract for a Kellogg radial brick chimney for the same plant. The chimney will be 11 feet internal diameter, by 175 feet high. Further orders recently received include the following:—One 75 h.p. Bellis & Morcom engine for the town of Kamloops, Alta.; one 540 h.p. Bellis & Morcom compound engine for the Fort William Starch Co., Ltd., Fort William, Ont.; one Bellis & Morcom air compressor of 5,000 cubic feet capacity for the Canadian Copper Co., Copper Cliff, Ont. This will be direct driven by a Swedish General Electric Company's motor of 940 h.p.

Personal

Alfred J. Jones, Montreal, has been appointed Canadian agent for Hick-Hargreaves & Co., Ltd., of Bolton, Eng., who have commenced the manufacture and sale of Diesel oil burning engines.

A. C. Towne has succeeded C. B. Ellis as manager of the electrical department of the Montreal branch of the Canadian H. W. Johns-Manville Co. Mr. Towne was formerly foreman of the electrical branch of the C. P. R. Angus shops.

T. J. Wilkinson, formerly of the Harvest Tool Co., Montreal, who left to take up an important position with the Nova Scotia Car Co. at Halifax, has returned to Montreal, and is now travelling representative of E. H. Drury & Co., wholesale steel merchants.

Thomas Burns, who has been assistant construction engineer of the Hydro-Electric Co., Prince Rupert, B.C., has been offered a position by the Ontario Hydro-Electric Power Commission as superintendent of the waterworks and lighting department at Midland, Ont.

Sir Alex. A. Binnie, the well-known London, Eng. civil engineer who was engaged by the city of Ottawa to report on the water supply has been obliged to relinquish the appointment on account of ill-health. W. Binnie & R. S. Tickell have been appointed to take care of the work.

Catalogues

Tate, Jones & Co., Inc., Pittsburgh, Pa., have sent us a copy of circular No. 142 which is entitled "Fuel Oil Data." The circular contains illustrations and descriptions of various types of oil heated furnaces, also much valuable information on the subject of fuel oil, especially with regard to its application for heating furnaces. Copies may be had on request.

The Canadian Allis-Chalmers Co., Toronto, have sent us a copy of bulletin No. 4032 describing the "Allis-Chalmers" friction clutch coupling and clutch pulley. Each type is fully illustrated, and tables giving the principal dimensions of each size and type are included. Some interesting data is given showing the information that should be sent in when ordering this equipment. Copies of this bulletin will be gladly sent to interested readers.

The Buffalo Forge Co., Buffalo, N.Y., have sent us a copy of Catalog No. 250, which is descriptive of the "Buffalo" mill exhausters. Particulars and velocity tables are given for various types and sizes of fans. Several illustrations are given showing installations of exhaust systems. The catalog also contains some useful engineering data suitable for this class of work. Copies may be had by writing the company in Buffalo, or the Canadian Buffalo Forge Co., Ltd., Montreal.

Bruce, Peebles & Co., Ltd Edinburgh, Scotland, have sent us a copy of pamphlet No. 20C, which has been revised and brought up-to-date. The pamphlet describes fully the "Peebles" converters especially with regard to the principle of operation and general design showing their suitability for traction or lighting purposes. Several illustrations are given of large plants where these converters have been installed. A table is included giving comparisons of motor converters with rotaries and motor generators. Copies of this pamphlet may be had on request.

The S. F. Bowser Company, Fort Wayne, Ind., have sent us a copy of their new bulletin, entitled "A Collapsible Oil Filter," and also a set of circulars descriptive of the various types of oil filters which they manufacture. The bulletin contains a complete description of the collapsible filter as applied to the "Bowser" oil filtering and circulating systems with illustrations. There is also some interesting information on the subject of lubrication and photographs of plants where the "Bowser" system has been installed. Copies will be sent on application to the Canadian office at Toronto, Ont., or to Fort Wayne.

Book Reviews

"**Steam Power Plants**" is the title of an unusually attractive forty-two page booklet recently published by Lockwood, Greene & Co., architects and engineers for industrial plants, 60 Federal Street, Boston. It describes in detail the construction and equipment of a few of the many well-known power plants designed by this concern. Unusually clear illustrations of both the exteriors and interiors of the plants are shown. Those interested in industrial power plant construction and equipment may obtain a copy of this booklet by addressing Lockwood, Greene & Co., 60 Federal Street, Boston.

MONCRIEFF'S "UNIFIC" WATER GAUGE GLASSES
Stand in a Class by Themselves for Quality, Efficiency and Economy
A trial will convince you. Write for Catalog
W. J. WALL, 136-134 BLEURY ST., MONTREAL
(Canadian Representative)

Classified Advertisements.

Those who wish to sell or buy a business, obtain competent help, connect with satisfactory positions or secure aid in starting new enterprises, should not fail to use the Want Ad. Page of The Power House.

Do you want to sell or buy a second hand engine or any other equipment? Let The Power House pick out a seller or buyer for you.

There is always some one looking for just such proposition as you have to offer.

RATES (payable in advance):—2c. per word first insertion, 1c. per word subsequent insertion. 5c. additional each insertion when Box Number is required. Each figure counts as one word.

AGENTS WANTED

LIBERAL COMMISSIONS TO DEALERS AND others handling Vulcan Soot Cleaners; applied to all types of boilers. Vulcan Tube Cleaning Systems, Limited, 42 Craig St. West, Montreal. (tf)

BUSINESS CHANCES

WANTED—EVERY ENGINEER TO GIVE US a chance to figure on electrical repairing. Don't worry about how far away you are. From Halifax to Vancouver is our field. The Mead Electric Co., Unity Building, Montreal, Que. (8)

WANTED — EVERY POWER HOUSE IN Canada to remember that C. E. Shedrick, Craig Street West, Montreal, is still repairing measuring instruments, both switchboard and portable. Twenty-five years' experience in repairing all kinds and makes on the market. Integrating meters repaired, tested and sealed, and returned on quick time. (tf)

FOR SALE

BELTING FOR SALE — 800,000 FEET OF best quality leather, rubber, hair and canvas belting, bought from bankrupt manufacturers at 25% to 75% less than the regular value. Also a large quantity of slightly used belting, piping, chains, rails, pulleys, hangers, cotton waste, etc., at very low prices. Send for catalogue. Imperial Belting & Supply Co., 5 Queen Street, Montreal. (tf)

FOR SALE—A 90 H.P. BRUCE MACBETH gas engine, complete with 75 K.V.A. dynamo, switchboard and exciter. All in first-class condition; in use less than four months; a bargain. The Winkley Company, Detroit, Mich. (10)

WANTED

THE PROPRIETORS OF LETTERS PATENT No. 127080 relating to "Process of Manufacturing Iron Electrodes for use in Alkaline Accumulators" and No. 127081 relating to "Active Masses for Positive Electrodes of Electric Elements, etc." desire to dispose of the Patents or to grant Licenses to interested parties at reasonable terms with a view to the adequate working of the Patents in Canada. Inquiries to be addressed to the actual proprietors, Svenska Ackumulator Aktiebolaget Jungner, Stockholm, Sweden. (8)

MISCELLANEOUS

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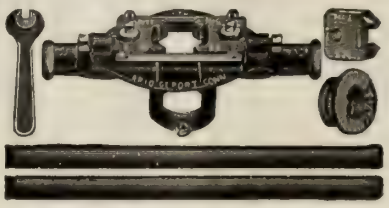

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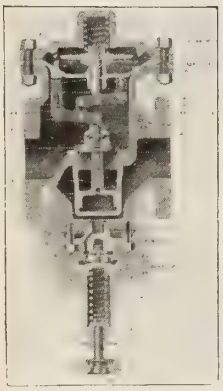

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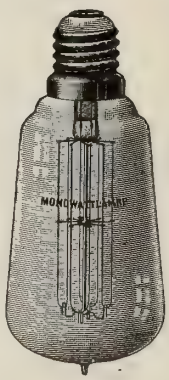

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First quality lamps in stock in every candle power at lowest prices.

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Everyone operating a Stationary Steam Plant of 50 h.p. or over, in the Province of Ontario, must hold a Certificate from this Board. Anyone operating such a plant without a Certificate is liable to the penalties set forth in the Stationary Engineers' Act

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Minister of Agriculture.

W. C. McGHIE,
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$75 A YEAR

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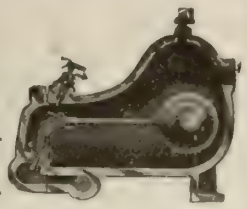
FOR HIGH OR LOW PRESSURE.

Steam can't blow through. They have large discharge valves and cannot be flooded from sudden flushes of water.

MAY WE SEND ONE FOR TRIAL?

Reducing Valves, Pump Governors, Relief Valves, Exhaust Pipe Heads, Ejectors and Steam Separators. SEND FOR CATALOGUE.



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Gas Producer Engine

in Perfect Running Condition

Selling to make space in congested shop.

Complete Equipment $550

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Don't Use Boiler Compounds

Which are always injurious to boilers and valves.

We guarantee an absolute Metal Clean Boiler, when there is sufficient exhaust steam. Get the Nobis habit around your power plant.

Best References

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ENGINEER, MANUFACTURER AND HEATING CONTRACTOR
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Scandinavia Belting

Is solidly woven under high tension. It is surface hardened and anti-frictioned throughout. It has neither lap nor seams.

EFFECTIVE FOR DIRECT OR MAIN DRIVES.

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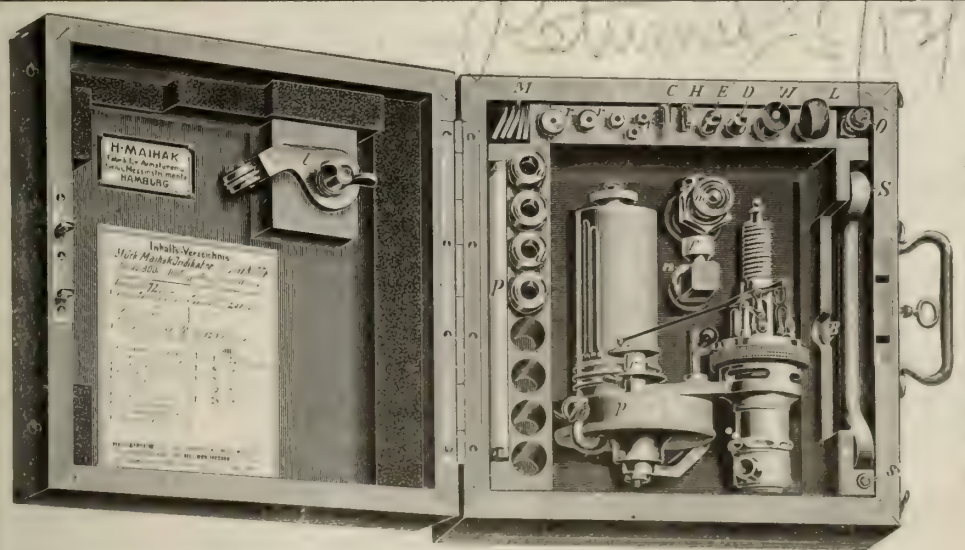

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of the Maihak Indicator, Tachometers, Tachographs, Stroke Counters, Revolution Counters and

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This indicator made in Germany is the best in the world.

Outside spring, and easily exchanged.

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Solve Coal, Machinery and Merchandise Handling Problems.
Hand, Pneumatic and Electrically Operated.

Tell us what you wish to do, and we'll suggest the proper equipment for you.

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Bare and Insulated Electric Wire

Electric Light Line Wire. Incandescent or Flexible Cords.

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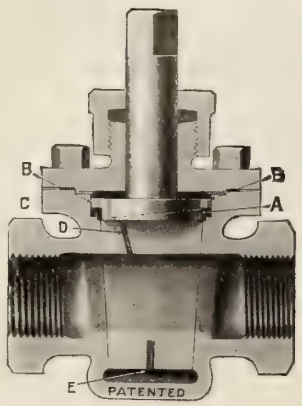

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in valves on your steam, hydraulic and pneumatic machinery, and the leaks in operating costs by specifying

"HOMESTEAD"

Straightway Valves for work on all high pressure and acid lines. They are plug valves that can't stick under any pressure. They have no packing and no adjusting nut. They don't corrode. **Send for Catalog 'R'' which tells fully about them.**

Homestead Valve Manufacturing Company

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We Guarantee

WALKER'S ELECTRIC BOILER COMPOUND

To Eradicate All Scale

We also guarantee that it will keep scale from forming if used regularly, that it will not injure your boilers, fittings or pumps in the slightest—that it will increase your boiler capacity and efficiency—that it will prevent pitting or corrosion or other boiler troubles due to impurities in the feed water—and that it will decrease your fuel bill.

Send us a sample of your feed water for analysis and get our prices.

Try a barrel—if it does not come up to our guarantee, ship it back at our expense.

You cannot afford to overlook this trial offer.

We carry all kinds of high-grade **Lubricating Oils, Greases, Packings and Engine Supplies.**

The Electric Boiler Compound COMPANY, LIMITED

Guelph, Ontario

Second Hand BOILERS

We have a few exceptionally good Second-Hand Horizontal Tubular Boilers in stock which we are offering at very attractive prices.

Some of them are practically new and all of them are in good order, and if you want a second-hand boiler, this is a particularly good opportunity for you.

Shall we send you particulars?

William Hamilton Co.

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The freight and duty is the same on **high grade coal** as on medium or low grade coal.

Our **Lone Star** small coal is **guaranteed** to show 14,000 B.T.U.'s regularly.

Our specialty in Canada is high grade coal from Kentucky and West Virginia via Detroit.

Let us have your inquiries, and call on us if in need of **prompt shipment,** via Buffalo, Car Ferry or Detroit.

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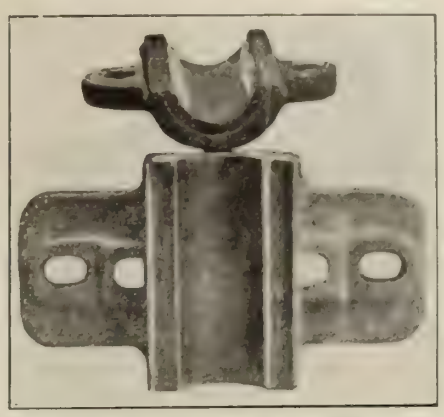

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Graphite is nature's greatest lubricant.

Pure graphite hardened in the **Graphitol** way makes the most frictionless machinery bearings possible.

Graphitol has recently been improved to such a degree of excellence that it is becoming of unquestioned value for many purposes.

Graphitol is shipped in powder form, is mixed with a prepared liquid when required, and applied in paste form, when it hardens durably.

Graphitol bearings mean reduced initial cost, greater efficiency, less oil, and cool running.

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You will either overtax it, which will necessitate costly repairs, or else you won't get all the power that is in it. The proper way to accurately determine the speed of any engine or machine is to use a

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It registers any speed without heating of parts. Equally good for motors, gas engines, line shafting, or any revolving machine. Rubber tips for centred or pointed shafts.

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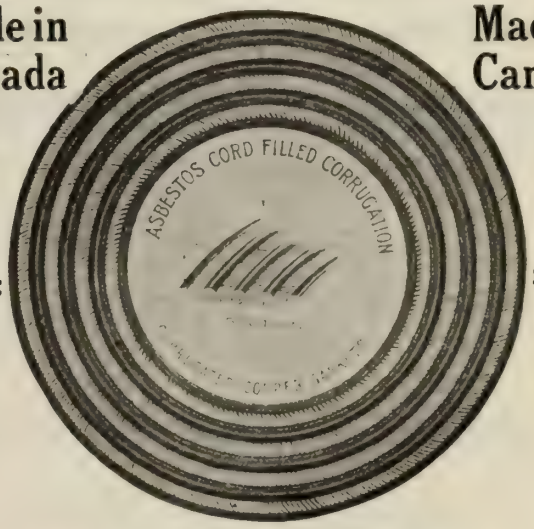
Made in Canada **Made in Canada**



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Absolutely the best and cheapest Gaskets on the Market to-day.

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Detroit Lubricators are made in styles and sizes for every kind of steam engine, pump, gas and gasoline engine or other machines of any kind.

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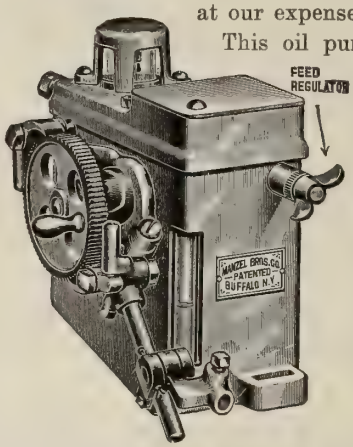
Detroit products are standard the world over. The first lubricator ever sold was manufactured by the Detroit Lubricator Company, and the reputation acquired as originators has been maintained by meeting at once every requirement in the entire field of lubrication, and by producing devices unequalled for efficiency, economy, durability, workmanship and quality of material. Over 1,250,000 Detroit Lubricators are in use to-day.

Write to-day for catalog G-58 and full information.

CANADIAN DETROIT LUBRICATOR COMPANY, LTD.
WALKERVILLE, ONTARIO
Largest manufacturers of lubricating device in the world.

Try This Oil Saver At Our Expense

We will send the **Manzel Automatic and Sight Feed Oil Pump to you on a 30 days' trial.** If it does not **save 50 per cent of your oil** return it at our expense.



This oil pump gives positive lubrication and feeds regularly regardless of steam pressure, temperature, speed of engine, or any kind of oil used.

Write us To-day.

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For city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

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TO THE STATIONARY ENGINEER WHO IS NOT A MEMBER OF THE C. A. S. E.

Have you ever seriously considered the necessity of mingling freely with your fellow-men whose life's occupation is the same as your own? If you have not, I would like to place before you the advantages which accrue to all thus associated.

We preach the doctrine of elevation of the Engineers through the medium of education.

By joining one of the subordinate associations of the C.A.S.E. you can gain knowledge of the character which is deemed so essential by successful practitioners of all the useful professions.

In all fairness I would ask you if an organization devoted to the calling at which you earn your daily bread is not entitled to special consideration from you?

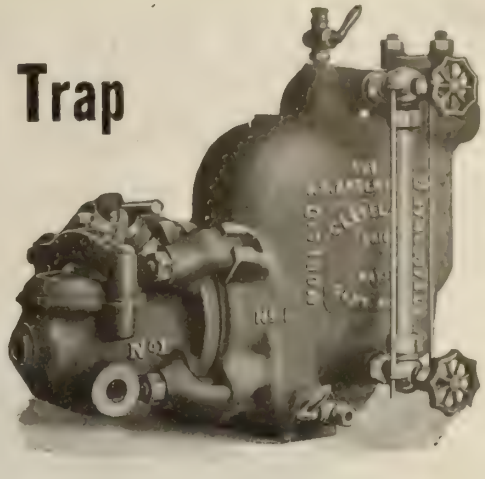
For further particulars write

A. KASTELLA
Executive Secretary
STRATFORD, - - - ONTARIO

Every part of

The Anderson Model "D" Steam Trap

is Designed to give Efficient and Economical Service

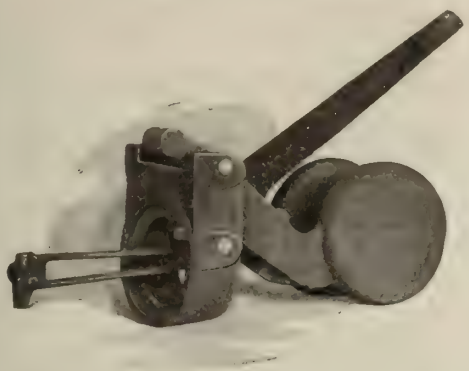


This is the perfect steam trap because it automatically and continuously drains the condensation from radiators, steam coils or heating system without reducing pressure or permitting the escape of live steam.

Model "D" steam traps can be changed from high to low pressure or vice versa by simply ordering the necessary valves and seats for pressure desired.

Removable perforated strainer which is part of the equipment, prevents pieces of scale, lead, etc., from entering traps.

All parts are interchangeable.



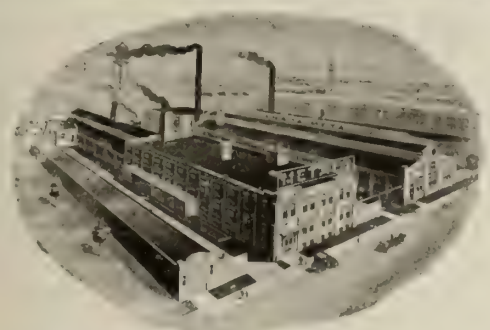
The cut below shows the complete working mechanism of a model "D" trap, consisting of Hanger, Float Lever, Counter Weight and Valve Connection assembled together to fit into its place on the head. These assembled parts are very accurately built, and fitted up with just the right amount of play to allow for expansion and insure free working.

Our booklet contains full description—drop a card for it **TO-DAY.**

THE V. D. ANDERSON Company

1935 West 95th St., CLEVELAND, OHIO

BRANCH OFFICES: 330 Manhattan Building, Chicago, Ill.; 619 Park Bldg., Pittsburg, Pa.; 3 Arch St., Philadelphia, Pa.; 212 Walnut St., Cincinnati, Ohio; 207 Union Trust Building, Baltimore, Md.; 91 High Street, Boston, Mass.



SEND ME A BOX OF BABBITT
THE KIND THAT DOES NOT WEAR OUT

WE RECEIVED A LETTER from a customer a few days ago, the following is an extract, "Send me a box of Babbitt, same as last, I forget the name, but it 's the kind that does not wear out."

This is a Testimonial Indeed and one Straight from the Heart.

The writer of the letter above mentioned had evidently got a Babbitt Metal just suited to his specific purpose.

THAT IS WHERE WE EXCEL. We can advise you, it costs you nothing to take advantage of our years of practical experience. If you have Babbitt Troubles, why not ask our advice?

WE RECOMMEND

IMPERIAL GENUINE "The Highest Grade of Babbitt Metal manufactured" for all High Speed Engines and Bearings carrying extremely heavy loads.

HARRIS HEAVY PRESSURE "The Babbitt Metal Without a Fault" for all General Machinery Bearings.

ALUMINOID For Medium and Light Running Machinery.

EVERY USER OF BABBITT METALS SHOULD GET OUR PRICES.

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Head Office and Factory: TORONTO. Branch Factories: MONTREAL, WINNIPEG

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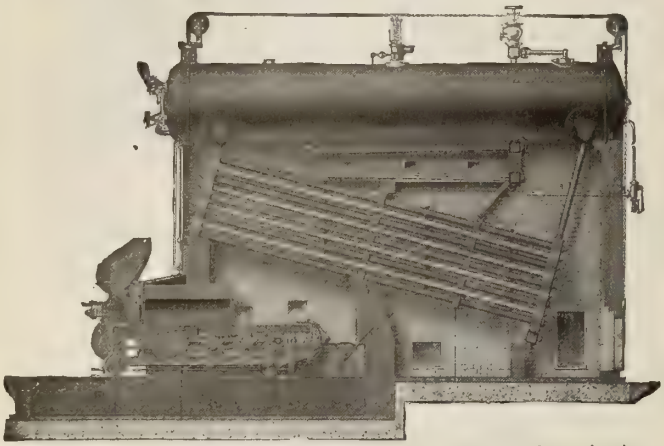
"B.&W." PATENT WATER TUBE STEAM BOILERS

With Furnaces for all Classes of Fuel or Waste Gases

HIGHEST ECONOMY, SAFETY, DURABILITY. OVER 10,000,000 H.P. IN USE



Babcock & Wilcox Patent Water Tube Steam Boiler, Superheater and Mechanical Stoker.

ALSO

Steam Superheaters
Mechanical Stokers
Coal-Handling Machinery
Piping, Feed Water Heaters
Water Softeners and Purifiers
and **ELECTRIC CRANES**

Our Book "STEAM" sent on request

HEAD OFFICE FOR CANADA - COLLEGE ST. (ST. HENRY), MONTREAL

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Our offices are at 705 C. P. R. Building, and inquiries addressed there will have the immediate personal attention of Mr. A. W. Crouch, Vice-President and General Manager.

The Dearborn Company has specialized on the analysis and scientific treatment of boiler feed waters for more than twenty-five years, and Dearborn Preparations for the removal of scale, prevention of corrosion, and pitting, and elimination of foaming, are successful because of the company's vast experience and the scientific methods employed.

Please Command Us

Dearborn Chemical Company of Canada, Limited

705 C.P.R. Building, Toronto, Canada

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To our Readers:—Use this directory when seeking to buy power equipment or supplies. You will often get information that will save you money.

To our Advertisers:—Send in your name for insertion under the heading of the lines you make or sell.

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Boiler Mountings.
Babcock & Wilcox, Montreal.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Darling Bros., Montreal.
Lunkenheimer Co., Cincinnati, O.

Boiler Tube Cleaners.
Garlock Packing Co., Hamilton, Ont.
Liberty Mfg. Co., Pittsburg.
Vulcan Tube Cleaning Systems, Ltd., Montreal.

Boilers, Horizontal, Return, Tubular and Watertube.
Babcock & Wilcox, Montreal.
Goldie & McCulloch Co., Galt.
Can. Allis-Chalmers, Ltd., Toronto.
Boving & Co. of Canada, Limited, Toronto.
Engineering Works of Canada, Ltd., Montreal.
Frick Co., Waynesboro, Franklin Co., Pa.
Hamilton Co., Wm., Peterborough, Ont.
Jenckes Machine Co., Sherbrooke, Que
Jones Underfeed Stoker Co., Toronto.
E. Leonard & Sons, London, Ont.
John McDougall Caledonian Iron Wks, Montreal.
Polson Iron Works, Toronto.
International Engineering Works, Ltd., Amherst, N. S.
Waterous Engine Wks. Co., Brantford

Boilers, Marine, Locomotive and Vertical.
Babcock & Wilcox, Montreal.
Goldie & McCulloch Co., Galt.
Can. Allis-Chalmers, Ltd., Toronto.
Jenckes Machine Co., Sherbrooke, Que
E. Leonard & Sons, London, Ont.
John McDougall Caledonian Iron Wks, Montreal.
Polson Iron Works, Toronto.
International Engineering Works, Ltd., Amherst, N. S.
Waterous Engine Wks. Co., Brantford

Brine Coolers.
Frick Co., Waynesboro, Franklin Co., Pa.

Brine Tanks.
Frick Co., Waynesboro, Franklin Co., Pa.

Cables, Aerial and Underground.
Eugene F. Phillips Electrical Works, Ltd., Montreal.

Cans, Oily Waste.
Jas. Morrison Brass Mfg. Co., Toronto.

Car Wheels.
American Pulley Co., Philadelphia.

Carbon Brushes.
Rougier Freres, Montreal.
Lunkenheimer Co., Cincinnati, O.

Cast Iron Fittings.
Lunkenheimer Co., Cincinnati, O.

Castings, Brass and Iron.
Lunkenheimer Co., Cincinnati, O.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.

Cement, Fireproof.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.

Cement Machinery.
Canadian Fairbanks-Morse Co., Ltd., Montreal.

Chemicals.
Dearborn Chemical Co., Chicago.
C. C. Snowdon, Calgary.

Circuit-Breakers.
Engineering Works of Canada, Ltd., Montreal.
Can. Gen. Elec. Co., Ltd., Toronto.
Can. Westinghouse Co., Hamilton.
Siemens Co. of Canada, Ltd. Montreal.

Coal.
Ohio & Michigan Coal Co., Detroit, Mich.

Clutches.
Elmira Machinery and Transmission Co., Elmira.
Waterous Engine Wks. Co., Brantford

Coal and Ash Conveyors.
Babcock & Wilcox, Montreal.
Ed. Bemis & Co., Bolton, Eng.
Hare Eng. Co., Toronto.
Jeffrey Mfg. Co., Columbus, O.
Geo. H. Tod, Toronto.

Coal Handling Machinery.
Ed. Bemis & Co., Bolton, Eng.
Hare Eng. Co., Toronto.
Geo. H. Tod, Toronto.
Jeffrey Manufacturing Co., Columbus.

Coils.
Frick Co., Waynesboro, Franklin Co., Pa.

Collars.
Can. Bond Hanger & Coupling Co., Alexandria, Ont.

Cold Storage Insulation.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.

Condensers.
American Steam Pump Co., Battle Creek, Mich.
Can. Allis-Chalmers, Ltd., Toronto.
Boving & Co. of Canada, Limited, Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
Goldie & McCulloch Co., Galt.
John McDougall Caledonian Iron Wks, Montreal.
Hare Eng. Co., Toronto.
Waterous Engine Wks. Co., Brantford
Arctic Ice Machine Co., Canton, Ohio.

Condensers, Ammonia and Steam.
Frick Co., Waynesboro, Franklin Co., Pa.

Cold Store Doors and Windows.
Jones Cold Store Door Co., Hagerstown, Md.

Condensation Receiver.
G. M. Davis Regulator Co., Chicago.

Conduits.
E. Leonard & Sons, London, Ont.
Can. H. W. Johns-Manville Co., Toronto.

Consulting Engineers.
Bayfield & Archibald, Vancouver, B.C
Chas. Bishop, M.I.C.S.A., Montreal.
de Gaspe Beaubien, Montreal.
John T. Farmer, Montreal.
Fetherstonhaugh & Co., Montreal.
Walter J. Francis, Montreal.
Jacobs & Davies, Inc., Montreal.
Pratt & Ross, Toronto.
J. M. Robertson, Montreal.
J. M. Shanly, Montreal.
Surveyor & Frigon, Montreal.
A. V. Tracy-Gould, Montreal.

Contractors, Structural Steel.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Can. Allis-Chalmers, Ltd., Toronto.

Conveyor Machinery.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Engineering Works of Canada, Ltd., Montreal.
Jeffrey Manufacturing Co., Columbus.
Waterous Engine Wks. Co., Brantford

Cooler Doors.
Jones Cold Store Door Co., Hagerstown, Md.

Cork Insert Pulleys.
American Pulley Co., Philadelphia.

Cork Insulation.
Can. H. W. Johns-Manville Co., Toronto.

Corliss and Rocking Valve.
Can. Allis-Chalmers, Ltd., Toronto.

Cotton Hose.
Garlock Packing Co., Hamilton, Ont.
Quaker City Rubber Co., Philadelphia.

Couplings.
Can. Bond Hanger & Coupling Co., Alexandria, Ont.
Boving & Co. of Canada, Limited, Toronto.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Elmira Machinery and Transmission Co., Elmira.
Jeffrey Manufacturing Co., Columbus.

Cranes, Electric.
Babcock & Wilcox, Montreal.
Can. Allis-Chalmers, Ltd., Toronto.
Smart-Turner Machine Co., Ltd., Hamilton.

Crank and Crosshead Pin Oilers
Lunkenheimer Co., Cincinnati, O.

Crushing Machinery.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Can. Allis-Chalmers, Ltd., Toronto.

Damper Regulators.
Darling Bros., Montreal.
G. M. Davis Regulator Co., Chicago, Ill.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
Jas. Morrison Brass Mfg. Co., Toronto.

Detector Phones.
The Maihak Indicator Agency, Montreal.

Distilling Apparatus.
Frick Co., Waynesboro, Franklin Co., Pa.

Doors, Cold Storage and Freezer.
Jones Cold Store Door Co., Hagerstown, Md.

Double Pipe Condensers.
Frick Co., Waynesboro, Franklin Co., Pa.

Dry Cleaners Systems.
S. F. Bowser & Co., Inc., Toronto.

Drying Machinery.
Can. Fairbanks-Morse Co., Montreal.

Dynamos.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.
Siemens Co. of Canada, Ltd. Montreal.

Economizers.
Babcock & Wilcox, Montreal.
Can. Fairbanks-Morse Co., Montreal.

Ejectors.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
Smart-Turner Machine Co., Ltd., Hamilton.

Electric Fans.
Canadian General Electric Co., Ltd., Toronto.
Siemens Co. of Canada, Ltd. Montreal.

Electrical Accessories and Machinery.
Can. Fairbanks-Morse Co., Montreal.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Canadian H. W. Johns-Manville Co., Toronto.
Engineering Works of Canada, Ltd., Montreal.
Monarch Electric Co., St. Lambert, Que.
Northern Electric & Mfg. Co., Limited Montreal.

Electrical Repairs.
Siemens Co. of Canada, Ltd. Montreal.

Elevators.
Engineering Works of Canada, Ltd., Montreal.
John McDougall Caledonian Iron Wks, Montreal.

Elevating Machinery.
Can. Fairbanks-Morse Co., Montreal.
Engineering Works of Canada, Ltd., Montreal.
Goldie & McCulloch Co., Galt.
Jeffrey Manufacturing Co., Columbus.
Waterous Engine Works Co., Brantford.
Can. Allis-Chalmers, Ltd., Toronto.

Engineers' Supplies.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.

Engines, Automatic and Drop Valve.
Can. Allis-Chalmers, Ltd., Toronto.
Frick Co., Waynesboro, Franklin Co., Pa.
E. Leonard & Sons, London, Ont.
International Engineering Works, Ltd., Amherst, N. S.
Waterous Engine Works Co., Brantford.

Engines, Corliss and Rocking Valve.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que
E. Leonard & Sons, London, Ont.
International Engineering Works, Ltd., Amherst, N. S.
Waterous Engine Works Co., Brantford.

Engines, Gas and Gasoline.
Can. Allis-Chalmers, Ltd., Toronto.
Boving & Co., of Canada, Limited, Toronto.
Canadian Westinghouse Co., Hamilton.
E. Leonard & Sons, London, Ont.
John Robson (Shipley) Ltd., Shipley, Eng.
Smart-Turner Machine Co., Ltd., Hamilton.

Engines, High Speed, Steam.
Boving & Co., of Canada, Limited, Toronto.
Engineering Works of Canada, Ltd., Montreal.
Goldie & McCulloch Co., Galt.
Laurie & Lamb, Montreal.
E. Leonard & Sons, London, Ont.
John McDougall Caledonian Iron Wks, Montreal.
International Engineering Works, Ltd., Amherst, N. S.
Waterous Engine Works Co., Brantford.

Engines, Marine.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
E. Leonard & Sons, London, Ont.
Laurie & Lamb, Montreal.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.

Engines, Saw Mill.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que
Laurie & Lamb, Montreal.
E. Leonard & Sons, London, Ont.
International Engineering Works, Ltd., Amherst, N. S.
Waterous Engine Works Co., Brantford.
Can. Allis-Chalmers, Ltd., Toronto.

Engines, Single, Compound and Triple Expansion.
Boving & Co., of Canada, Limited, Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Laurie & Lamb, Montreal.
E. Leonard & Sons, London, Ont.
John McDougall Caledonian Iron Wks, Montreal.
Kerr Engine Co., Walkerville.
International Engineering Works, Ltd., Amherst, N. S.
Waterous Engine Works Co., Brantford.

Engines, Vertical.
Laurie & Lamb, Montreal.
E. Leonard & Sons, London, Ont.
International Engineering Works, Ltd., Amherst, N. S.

Engineers' Supplies.
Lunkenheimer Co., Cincinnati, O.

Exhaust Fans.
W. H. Allen Son & Co. Bedford, Eng.
Hare Eng. Co., Toronto.

Exhaust Heads.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
Jas. Morrison Brass Mfg. Co., Toronto.
The Sims Co., Erie, Pa.
Steam Appliance Co., Milwaukee, Wis.
Watson & McDaniel Co., Philadelphia

Expansion Joints.
Lunkenheimer Co., Cincinnati, O.

Feed Water Alarms.
H. L. Peller & Co., Montreal.

Feed Water Analyser.
C. C. Snowdon, Calgary.

Feed Water Heaters.
Alberger Condenser Co., New York.
Babcock & Wilcox, Montreal.
Can. Fairbanks-Morse Co., Montreal.
Can. Allis-Chalmers, Ltd., Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
National Pipe Bending Co., New Haven, Conn.
International Engineering Works, Ltd., Amherst, N. S.
Nobis Engineering Co., Toronto.
The Sims Co., Erie, Pa.
Waterous Engine Works Co., Brantford.

Feed Water Regulators.
Can. Allis-Chalmers, Ltd., Toronto.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
Ronald Trist & Co., London, Eng.

Filters.
John McDougall Caledonian Iron Wks, Montreal.

Fire Hose.
Quaker City Rubber Co., Philadelphia, Pa.
Reddaway & Co., F., Montreal.

Fireproof Cold Store Doors and Windows.
Jones Cold Store Door Co., Hagerstown, Md.

Flanged Pulleys.
American Pulley Co., Philadelphia.

Flanges.
Dart Union Co., Toronto.
Lunkenheimer Co., Cincinnati, O.

Flue Brushes.
Steam Appliance Co., Milwaukee, Wis.

Flumes, Steel.
Boving & Co., of Canada, Limited, Toronto.
E. Leonard & Sons, London, Ont.

Freezer Doors.
Jones Cold Store Door Co., Hagerstown, Md.

Insulators.
Ed. Bemis & Co., Bolton, Eng.
Geo. H. Tod, Toronto.

Furnace Linings.
Hare Eng. Co., Toronto.

Fuses.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.
Canadian General Electric Co., Ltd., Toronto.

Gaskets, Rubber, Asbestos, Lead and Copper.
Can. Gasket Co., Bridgeburg, Ont.
Frick Co., Waynesboro, Franklin Co., Pa.
Goetze-Gasket & Packing Co., New Brunswick.
Canadian H. W. Johns-Manville Co. Ltd., Toronto.
Garlock Packing Co., Hamilton, Ont.

Gas Exhausters.
Hare Eng. Co., Toronto.

Gas Producer Plants.
Boving & Co., of Canada, Limited, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Can. Allis-Chalmers, Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
E. Leonard & Sons, London, Ont.

Gasolene & Oil Storage & Distributing Systems.
S. F. Bowser & Co., Inc., Toronto.

Gauge Cocks.
Can. Fairbanks-Morse Co., Montreal.
Hare Eng. Co., Toronto.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
Ohio Brass Co., Mansfield, Ohio.
W. J. Wall, Montreal.
Garlock Packing Co., Hamilton, Ont.
Lunkenheimer Co., Cincinnati, O.

Gauges—Pressure, Vacuum, Draft and Recording.
Babcock & Wilcox, Montreal.
Lunkenheimer Co., Cincinnati, O.

Gauges, Water.
Jenkins Bros., Ltd., Montreal.
The Lunkenheimer Co., Cincinnati, O.
Ohio Brass Co., Mansfield, Ohio.

Gears, Cut, Worm, Mortise.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.

Generators.
Siemens Co. of Canada, Ltd. Montreal.
Can. Fairbanks-Morse Co., Montreal.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.
Northern Electric & Mfg. Co., Limited, Montreal.

Graphite, Boiler.
Jos. Dixon Crucible Co., Jersey City.
Federal Graphite Mills, Cleveland.
C. C. Snowdon, Calgary.

Governor, Water Wheel.
Can. Allis-Chalmers, Ltd., Toronto.

Graphitol.
British Pacific Supply Co., Victoria, B.C.

Grates.
Babcock & Wilcox, Montreal.
Ed. Bemis & Co., Bolton, Eng.
Boiler Repair & Grate Bar Co., Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Hare Eng. Co., Toronto.
Geo. H. Tod, Toronto.

Grease Cups.
Detroit Lubricator Co., Walkerville.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
Peterborough Machine & Lubricator Co., Ltd., Peterborough.

Grease and Oil Extractors.
Can. Allis-Chalmers, Ltd., Toronto.
Elliott Co., Pittsburgh, Pa.
C. C. Snowdon, Calgary.
Hare Eng. Co., Toronto.
Steam Appliance Co., Milwaukee, Wis.

Greases.
Adams Cooks Son, New York.
Albany Lubricating Co., New York.
British Pacific Supply Co., Victoria, B. C.
Can. Fairbanks-Morse Co., Montreal.
Can. Oil Companies, Ltd., Toronto.
Jos. Dixon Crucible Co., Jersey City.
C. C. Snowdon, Calgary.

Hangers.
Can. Bond Hanger & Coupling Co., Alexandria.
Can. Fairbanks-Morse Co., Montreal.
Elmira Machinery and Transmission Co., Elmira.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

Heaters.
Can. Allis-Chalmers, Ltd., Toronto.
Darling Bros., Montreal.
Goldie & McCulloch Co., Galt.
Hare Eng. Co., Toronto.
E. Leonard & Sons, London, Ont.
The Sims Co., Erie, Pa.

Heating Engineers.
Nolis Engineering Co., Toronto.

Hoists.
Engineering Works of Canada, Ltd., Montreal.
Nobis Engineering Co., Toronto.

Hose, Steam, Suction and Water.
Garlock Packing Co., Hamilton, Ont.

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Can. Allis-Chalmers, Ltd., Toronto.
Smart - Turner Machine Co., Ltd., Hamilton.

Hydraulic Machinery.
Engineering Works of Canada, Ltd., Montreal.
John McDougall Caledonian Iron Wks, Montreal.
Nolis Engineering Co., Toronto.

Hydraulic Presses.
Bawden Machine Co., Toronto.

Ice Making Machinery.
Arctic Ice Machine Co. Canton, Ohio.
Frick Co., Waynesboro, Franklin Co., Pa.
Linde British Refrigeration Co., Montreal.
York Mfg. Co., York, Pa.

Indicators, Electric—All Types.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton

Indicators, Steam and Gas Engine.
Can. Fairbanks-Morse Co., Montreal.
The Maihak Indicator Agy., Montreal.

Indicators—Ammonia, Hydraulic.
Detroit Lubricator Co., Walkerville.

Indicating.
Renown Engine & Machine Co., Montreal.

Injectors.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
Penberthy Injector Co., Windsor.

Filters, Water.
Frick Co., Waynesboro, Franklin Co., Pa.

Furnaces.
Monarch Electric Co., St. Lambert, Que.

Iron Filler.
Imperial Waste & Metal Co., Montreal.

Lace Leathers.
Graton & Knight Mfg. Co., Worcester, Mass.

Lamps, Tungsten, etc.
Canadian General Electric Co., Ltd., Toronto.

Lamps, Arc, Incandescent.
Canadian General Electric Co., Ltd., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Canadian Westinghouse Co., Hamilton
P. H. Klein, Jr., Co., Montreal.
Northern Electric & Mfg. Co., Limited, Montreal.

Lubricants.
British Pacific Supply Co., Victoria.
Can. Oil Companies, Ltd., Toronto.
Jos. Dixon Crucible Co., Jersey City.
C. C. Snowdon, Calgary.

Lubricators, Force Feed.
Darling Bros., Montreal.
Can. Detroit Lubricator Co., Windsor,
Lunkenheimer Co., Cincinnati, O.
Manzel Bros. Co., Buffalo, N.Y.
Peterborough Machine & Lubricator Co., Ltd., Peterborough.

Lubricators, Plain.
Can. Detroit Lubricator Co., Windsor, Ont.
Lunkenheimer Co., Cincinnati, O.

Mechanical Stokers.
Babcock & Wilcox, Montreal.
Ed. Bemis & Co., Bolton, Eng.
Fraser & Chalmers, Ltd., Montreal.
Hare Eng. Co., Toronto.
Jones Underfeed Stoker Co., Toronto.
Murphy Iron Works, Detroit, Mich.
Geo. H. Tod, Toronto.

Metal Spools.
American Pulley Co., Philadelphia.

Meters, Electric.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Monarch Electric Co., St. Lambert, Que.
Siemens Co. of Canada, Ltd. Montreal.

Metres, Steam.
Nobis Engineering Co., Toronto.

Meters, Water.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Siemens Co. of Canada, Ltd. Montreal.

Mica.
Kent Brothers, Kingston, Ont.

Mill Supplies.
Andrews & Son, F. H., Quebec.
Reddaway & Co., F., Montreal.

Mill and Mining Machinery.
Can. Fairbanks-Morse Co., Montreal.
Engineering Works of Canada, Ltd., Montreal.
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co. Sherbrooke, Que
International Engineering Works, Ltd., Amherst, N. S.
Waterous Engine Works Co., Brantford.
Can. Allis-Chalmers, Ltd., Toronto.

Molds, Rubber.
Bawden Machine Co., Toronto.

Motors.
Can. Fairbanks-Morse Co., Montreal.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.
Northern Electric & Mfg. Co., Limited, Montreal.
Siemens Co. of Canada, Ltd. Montreal.

Motor Starters and Controllers.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.
Siemens Co. of Canada, Ltd. Montreal.

Office Railings.
Jas. Morrison Brass Mfg. Co., Toronto.

Oil Cups.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.

Oiler Compound Feeders.
Lunkenheimer Co., Cincinnati, O.

Oilers, Gauge.
Lunkenheimer Co., Cincinnati, O.

Oilers, Multiple.
Can. Detroit Lubricator Co., Windsor,
Lunkenheimer Co., Cincinnati, O.

Oil Filters & Circulating Systems.
S. F. Bowser & Co., Inc., Toronto.
Darling Bros., Montreal.
Elliott Co., Pittsburgh, Pa.
Jas. Morrison Brass Mfg. Co., Toronto.
The Sims Co., Erie, Pa.

Oil Separators, Ammonia.
Steam Appliance Co., Milwaukee,

Oil Separators.
Babcock & Wilcox, Montreal.
Can. Fairbanks-Morse Co., Montreal.
Can. Allis-Chalmers, Ltd., Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
C. A. Dunham Co., Toronto.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
Liberty Mfg. Co., Pittsburg.
Jas. Morrison Brass Mfg. Co., Toronto.
Smart - Turner Machine Co., Ltd., Hamilton.
Steam Appliance Co., Milwaukee.

Oiling Systems.
S. F. Bowser & Co., Inc., Toronto.

Oils, Lubricating.
British Pacific Supply Co., Victoria.
Can. Oil Companies, Ltd., Toronto.
Dearborn Chemical Co., Chicago.
C. C. Snowdon, Calgary.

Packing Engine.
Can. H. W. Johns-Manville Co., Toronto.
Dunlop Tire & Rubber Goods Co., Toronto.
Garlock Packing Co., Hamilton, Ont.
Steel Mill Packing Co., Windsor, Ont.

Packing, Metallic.
Holmes Metallic Packing Co., Wilkesbarre, Pa.
Quaker City Rubber Co., Philadelphia, Pa.
Steel Mill Packing Co., Windsor, Ont.

Packing, Rod.
Goetze-Gasket & Packing Co., New Brunswick, N.J.
Canadian H. W. Johns-Manville Co. Ltd., Toronto.
Garlock Packing Co., Hamilton, Can.
Steel Mill Packing Co., Windsor, Ont

Packing, Sheet.
Garlock Packing Co., Hamilton, Can.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.
Jenkins Bros., Ltd., Montreal.
Quaker City Rubber Co., Philadelphia, Pa.

Warning!

All Dealers are hereby warned that any Infringement against "Camel Hair" Belting will be prosecuted to the full extent of the Law.

IN THE EXCHEQUER COURT OF CANADA,

Saturday the 5th day of July, A.D. 1913.

Present: The Honourable Mr. Justice Audette.

Between F. Reddaway & Company, Limited, and Frank Reddaway, Plaintiffs,
And J. C. McLaren Belting Co., Limited, Defendant.

This action having this day come on before this court on motion for judgment on behalf of the plaintiffs upon hearing read the consent of the defendant herein, and upon hearing counsel for the plaintiffs,

This court doth order and adjudge that the defendant, its servants and agents, employees and workmen be and they are hereby restrained from using the trade mark described in the statement of claim filed herein, and from otherwise infringing the said trade mark;

And this court doth further order and adjudge that the defendant, its servants, agents, employees and workmen be and they are hereby restrained from using the word "Camel" or "Camel-hair" or any name liable to deceive purchasers into the belief that they are purchasing goods of plaintiff's manufacture, and also restraining the said defendant from passing off its goods as and for goods of plaintiff's manufacture.

And this court doth further order and adjudge that the defendant pay the costs of the present action to the plaintiffs after taxation thereof.

By the Court,
(Signed) CHAS. MORSE.
Registrar.

(Seal)

Certified a true copy,
(Signed) Chas. Morse, Registrar.

"Camel Hair" Belting is More Reliable, Efficient and Lower in Cost than any other, because

It has no plys to open up and fall apart.

It has no rubber or gum to heat and peel.

It lasts longer than any other belt on the market.

It slips just one-half that of any other belting.

It will run equally well in damp, wet, or a dry atmosphere.

It is less affected by acid fumes and high temperature than any other belting.

It is uniform in thickness and runs true.

Of its great strength—almost twice that of best oak-tanned double leather.

It requires much less attention than other styles of belting.

The stretch comes out quickly, and after taking up once or twice (according to load and nature of run) requires little or no more attention.

It transmits more power than any other belting.

Give Camel Hair Belting a trial and you will always use it.

F. REDDAWAY & CO.

Sole Manufacturers

595 ST. PAUL STREET - - MONTREAL, QUE.

The advertiser would like to know where you saw his advertisement—tell him.

Packing, Ammonia, Steam and Water.
Anchor Packing Co., of Canada, Walkerville.
Canadian H. W. Johns-Manville Co., Toronto.
Garlock Packing Co., Hamilton, Can.
Nobis Engineering Co., Toronto.
Quaker City Rubber Co., Philadelphia, Pa.
Steel Mill Packing Co., Windsor, Ont.

Packing, Leather.
Graton & Knight Mfg. Co., Worcester, Mass.

Patents.
Rowland Brittain, Vancouver, B.C.

Penstocks.
Can. Allis-Chalmers, Ltd., Toronto.
Boving & Co., of Canada, Limited, Toronto.

Penstock Lugs.
Otterville Mfg. Co., Otterville, Ont.

Pillow Blocks.
Can. Bond Hanger & Coupling Co., Alexandria.
Elmira Machinery & Transmission Co., Elmira, Ont.

Pipe Bending.
Nobis Engineering Co., Toronto.

Pipe Coils.
National Pipe Bending Co., New Haven, Conn.
York Mfg. Co., York, Pa.

Pipe Cutting and Treading Machine and Tools.
Can. Fairbanks-Morse Co., Montreal.

Pipe, Steel.
Can. Allis-Chalmers, Ltd., Toronto.
Boving & Co., of Canada, Limited, Toronto.
E. Leonard & Sons, London, Ont.

Pipe (Second-Hand).
Imperial Waste & Metal Co., Montreal.

Pipes, Water.
Can. Allis-Chalmers, Ltd., Toronto.
Boving & Co., of Canada, Limited, Toronto.
Pacific Coast Pipe Co., Vancouver, B. C.

Piping and Fittings.
Frick Co., Waynesboro, Franklin Co., Pa.
Jas. Morrison Brass Mfg. Co., Toronto.
York Mfg. Co., York, Pa.

Piping, Steam.
Babcock & Wilcox, Montreal.
Imperial Waste & Metal Co., Montreal.

Plate Work.
Can. Allis-Chalmers, Ltd., Toronto.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

Polish, Metal.
G. W. Hoffman, Indianapolis.

Power Pumps.
American Steam Pump Co., Battle Creek, Mich.
Boving & Co., of Canada, Limited, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Can. Allis-Chalmers, Ltd., Toronto.
Darling Bros., Montreal.
Goldie & McCulloch Co., Galt.
Goulds Pump Co., Montreal.
E. Leonard & Sons, London, Ont.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.
Waterous Engine Works Co., Brantford.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.
Garlock Packing Co., Hamilton, Can.

Power Transmission Machinery.
Can. Bond Hanger & Coupling Co., Alexandria, Ont.
Can. Fairbanks-Morse Co., Montreal.
Elmira Machinery & Transmission Co., Elmira, Ont.
Engineering Works of Canada, Ltd., Montreal.
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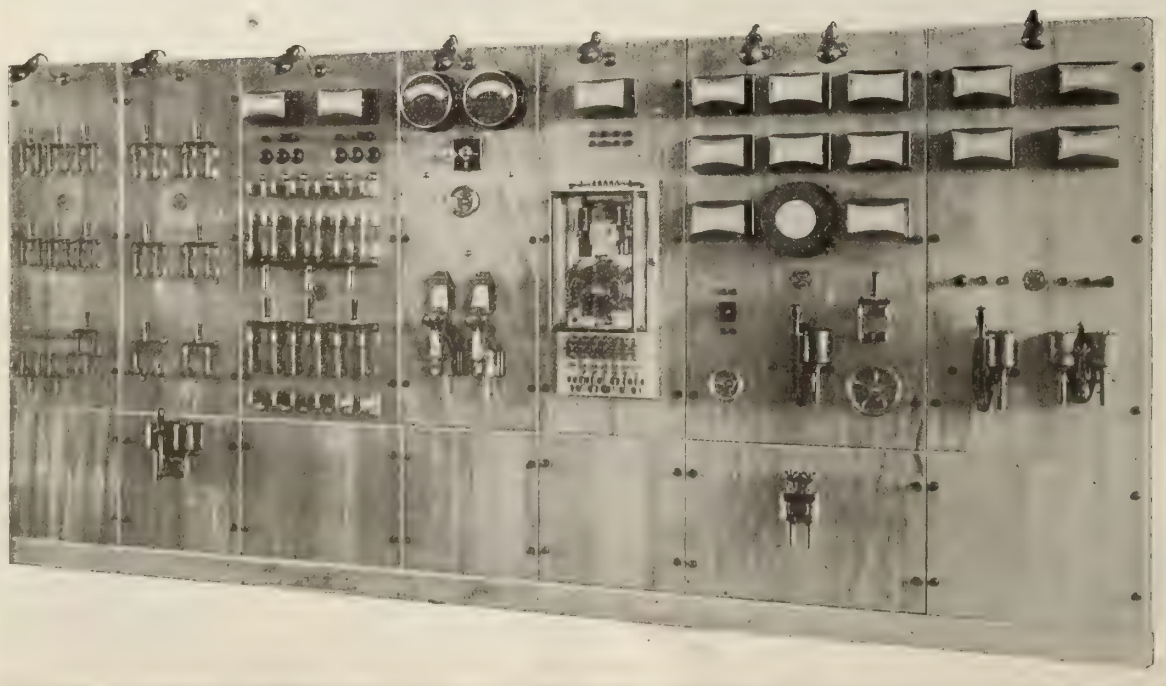

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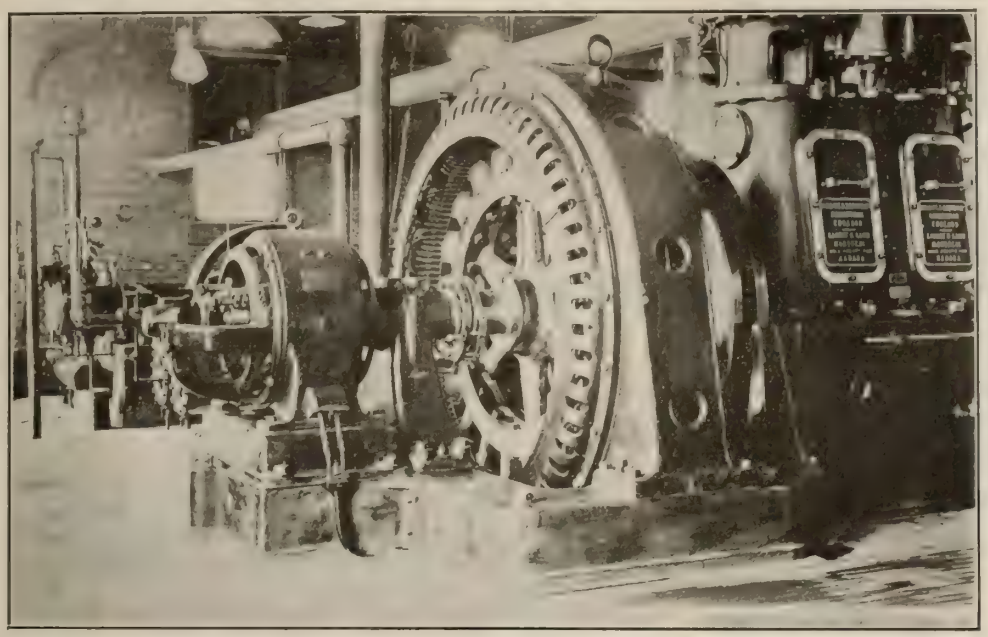

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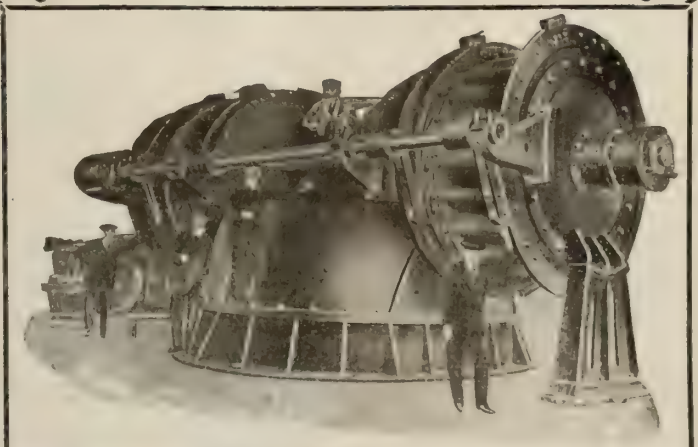

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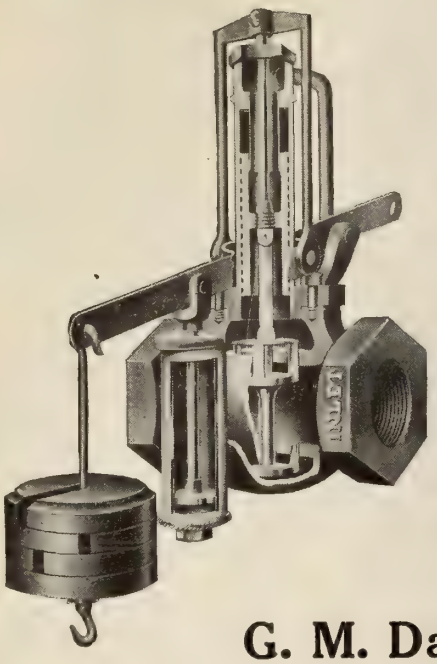

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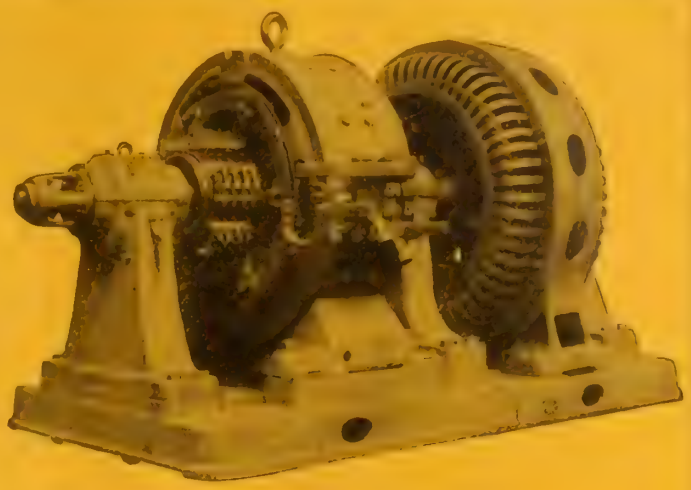
Westinghouse
Motor-Generator Sets



is due to the fact that they have been designed after careful study of power requirements and long experience in the application of electrical apparatus.

Some of their advantages are:

¶ *Sparkless commutation over a wide range of load and overload.*

¶ *High efficiency at all loads, particularly on fractional loads.*

¶ *Simplicity combined with ruggedness.*

Minimum attention required. High power factor at all loads. These are only a few of the many excellent features embodied in the design. Our nearest office will gladly give further information.

Canadian Westinghouse Co., Ltd., Hamilton, Ontario

TORONTO Traders Bank Bldg. | MONTREAL 52 Victoria Square | OTTAWA Ahearn & Soper, Ltd. | HALIFAX Telephone Bldg. | WINNIPEG 158 Portage Ave. E

CALGARY 311 8th Ave. West | VANCOUVER Bank of Ottawa Bldg.

ESCHER-WYSS & CO.

ENGINEERS

52,000 H.P. Plant Western Canada Power Co.

HYDRAULIC
STEAM | **PLANTS**
PUMPING

HEAD OFFICE FOR CANADA:

626 Coristine Bldg.,

MONTREAL, Que.

The advertiser would like to know where you saw his advertisement—tell him.

TRADE MARK J.M.T. REGISTERED
A GUARANTEE OF QUALITY

J. M. T. Globe Valve
Renewable Disc. Substantial in design for permanent service.

J. M. T. Pop Safety Valve
Made Flanged and screwed. Provincial approved.

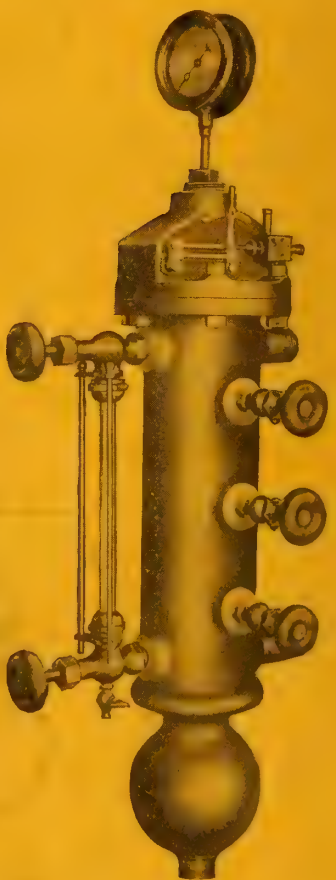
J. M. T. Improved Injector
Operates from 20 lbs to 220 lbs.

Everything in
Boiler Room Accessories
Highest Quality Guaranteed

The value of an article should be based upon the service it gives.
Morrison's Goods are the result of many year's experience and the aim is to always produce nothing but the best.
Our prices are right for that of good quality.
Let us quote for your requirements.

The James Morrison Brass Mfg. Company, Ltd.

93-97 Adelaide Street West **TORONTO**



"Reliable" Water Column Complete
With Water Gauge Mountings, Gauge Cocks, Pressure Gauge, and Whistle Alarm.

ALPHABETICAL INDEX ON LAST PAGE

BUYERS :—Refer to our Classified Index of Article Advertised on last few pages.

THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas Electric, Air and Water Power; and to the operation of Refrigerating Machinery.

Published by The MacLean Publishing Co., Limited.

MONTREAL: Eastern Townships Bank Bldg. TORONTO: 143-149 University Ave. LONDON, ENG.: 88 Fleet St. E.C. WINNIPEG: 34 Royal Bank Bldg.

Vol. VI. Publication Office, Toronto—September, 1913 No. 9

TRADE PENBERTHY MARK

"ALL QUALITY LINES"

Guaranteed for 200 pounds working pressure.

TRADE PENBERTHY MARK

"ALL QUALITY LINES"

Guaranteed for 200 pounds working pressure.

REGRINDING CHECK VALVES

VIZ:

SWING HORIZONTAL ANGLE VERTICAL

Approved by and Registered in

The Provinces of Ontario, Alberta and Saskatchewan for steam pressures as high as 200 lbs.

Design, workmanship, finish unequalled anywhere. Regrinding easily and quickly done at no extra expense, thus prolonging the life of the valve.

"Up to the Penberthy Standard of Excellence."

Specify them if you want the best check valves.

Write for catalog to-day. It's free for the asking.

Penberthy Injector Co., Limited · Windsor, Ont.

RAINBOW PACKING

"I should worry?"

MANUFACTURED EXCLUSIVELY BY

PEERLESS RUBBER MANUFACTURING COMPANY

16 WARREN ST., NEW YORK.

FOR SALE EVERYWHERE

The advertiser would like to know where you saw his advertisement—tell him.

Steel Plate Work

WE have made a success of building Steel Plate Work by specializing in it.

The 1911 extensions to our Shops have placed us in a better position than ever before to do this work. Our facilities in every department have materially increased—we have the men, the equipment, and the experience to turn out this special work as it should be.

We design and build any kind, any size, of:—

CONVEYORS	STEEL TANKS
SMOKE BREECHINGS	STORAGE BINS
STEEL STACKS	COOKERS and DIGESTERS
SPARK ARRESTERS	STEEL GAS MAINS
STEEL BUCKETS	REFUSE BURNERS
	ELEVATORS

Before you buy anything along these lines send us your sketch and let us quote.

The Waterous Engine Works Co., Limited

Brantford, Canada

The advertiser would like to know where you saw his advertisement—tell him.

A Dunham System

The "Crest" of perfection in Steam Heating, be it by Vacuum, Vapor or with an Air Line.

A system to meet your needs and conditions:—

A Vacuum System—to use exhaust steam from engines or other generating units. The Dunham Vacuum System insures quick circulation of steam, full efficiency of all radiating units and **No Waste.**

A Vapor System—where no exhaust is available, but where independent boilers for heating only are required. A Vapor System gains same advantages as with a Vacuum System at most economical operative costs for fuel and attendants.

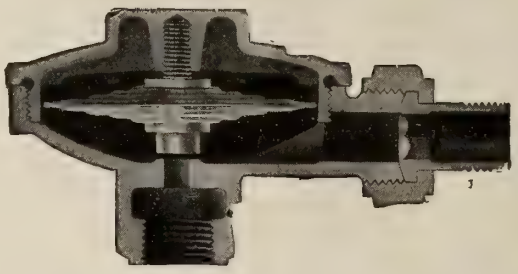
An Air Line System—for revamping old unsatisfactory gravity systems. First cost less than Vacuum or Vapor. The air line greatly facilitates circulation through a radiator which, under ordinary conditions, might be air bound.

These systems make use of the Dunham Thermostatic Specialties which are positive and durable, as proven by many years service.

Write for new catalog bulletin just from the press.

The Dunham Radiator Trap

(Made in Canada)



Passes water and air without loss or waste of steam. (Used on Vacuum and Vapor Systems.)

Is the Oldest Thermostatic Trap. Is backed by a strong organization. Is guaranteed to safe-guard every user.

Let us direct you to many satisfied customers.
Our Engineering Department will furnish information or advise you on any of your heating problems. Write us.

Our Engineering Staff is at your disposal

C. A. DUNHAM CO., LTD., Toronto, Can.

Halifax **Montreal** **Vancouver** **Winnipeg** **Calgary**

Sales Over Five Million Dollars Annually

Four Babbitt Manufacturing Plants

TORONTO **LONDON, ENG.** **NEW YORK** **ST. LOUIS**

Faultless "A" This babbitt is a high grade copper hardened alloy, possessing in a higher degree all the good points of the original Genuine Babbitt, with increased antifriction qualities, having the additional merit of absorbing and holding oil. It is used extensively in France for automobile engines, and in South Africa for mining machinery, and in United States and Canada for marine engines, dynamos and all heavy duty machines. Where heavy service is required this will last longer than any Genuine Babbitt manufactured. For heavy duty, saw mills and engines it is without equal.

Eagle "A" Thousands of tons of this alloy have been placed on the market, giving such perfect results, that it's name and merits are known, we believe, as extensively as any other babbitt manufactured. Its high antifriction and heavy duty qualities make it especially adapted for saw-mills, planing-mills, threshing engines, traction engines, pumps, rolling-mills and general machine shop use.

HOYT METAL COMPANY

TORONTO OFFICE AND MFG. PLANT—EASTERN AVE. AND LEWIS ST.

BOILERS

JENCKES

Will Serve You Efficiently And Economically

HEATING BOILERS

LOCOMOTIVE TYPES

VERTICAL TUBULAR

HORIZONTAL TUBULAR

The product of our boiler department has for years been well and favorably known throughout Canada, and our constant aim is to keep it in the place which merit has won.

We have facilities for turning out boilers to meet any requirement on short notice. Our boilers are made to conform with the various Provincial Inspection Acts. All are thoroughly tested and fully guaranteed.

LET US FURNISH YOU WITH COMPLETE DETAILS.

You will benefit by a thorough investigation. **Why not write us now?**

The Jenckes Machine Co., Limited

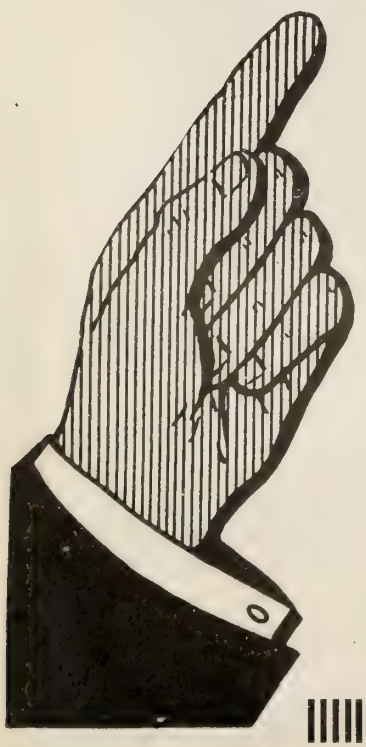
Sherbrooke Montreal St. Catharines Cobalt South Porcupine Nelson Vancouver

Works: SHERBROOKE, QUE. ST. CATHARINES, ONT.

The advertiser would like to know where you saw his advertisement—tell him.

Boiler Cleanser

The Only Real Boiler Compound that saves you money



Rids your boiler of all scale, mud, dirt, etc., prevents pitting, grooving, honeycombing; Saves fuel, and so treats the water that it absorbs more steam.

You take no chances when using potato scale boiler cleanser—there is absolutely nothing in it that will injure tubes or fittings.

It is sold under a guarantee that the buyer must be perfectly satisfied with it in every respect before he is called upon to pay a cent.

Used by thousands and has satisfied everybody.

Write us TO-DAY.

Once you have tried our **Numidian Cylinder, Velox Engine and Sliptivity Machine Oils** you will become a constant user.

C. C. SNOWDON

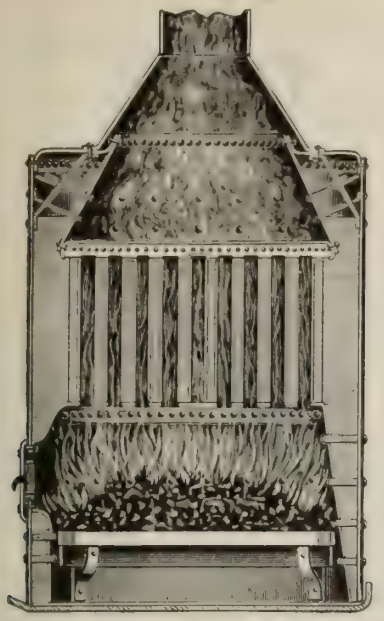
1810-1840 11th STREET EAST, CALGARY, ALBERTA
P. O. Box 1384

Refiner Importer and Manufacturer of

Pennsylvania Lubricating and Refined Oils, Gasoline, Potato Scale Powder, Liquid Soap, Disinfectants, Polish, Waste, Oil Tanks, etc.

Branches:— Edmonton Winnipeg Vancouver

The advertiser would like to know where you saw his advertisement—tell him.



You Will Benefit By

a thorough investigation of our boilers.

They are the result of long experience, best materials and expert supervision.

Look up the past and present record of our boilers.

We will take the greatest pleasure in getting you in touch with some users—the evidence of users will cost you nothing. Our boilers will do the same for you as they do for others.

WRITE TO-DAY.

We build various types:

Scotch, Clyde, Fitzgibbon, Vertical, Mosher.

Highest Grade BOILERS

Horizontal, Tubular, Vertical, Locomotive Type, "Heine" Water Tube.

Polson Iron Works,

LIMITED

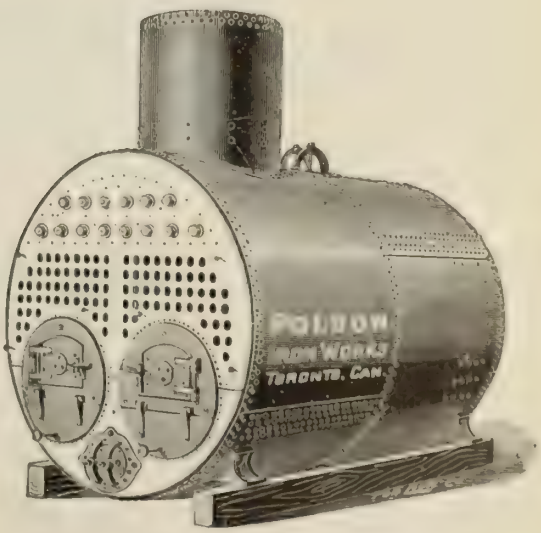
Steel Shipbuilders, Engineers and Boilermakers

TORONTO, CAN.

Representatives in Canada for

The B. F. Sturtevant Co., Hyde Park, Mass., U.S.A. Fans, Blowers, Heating and Ventilating.

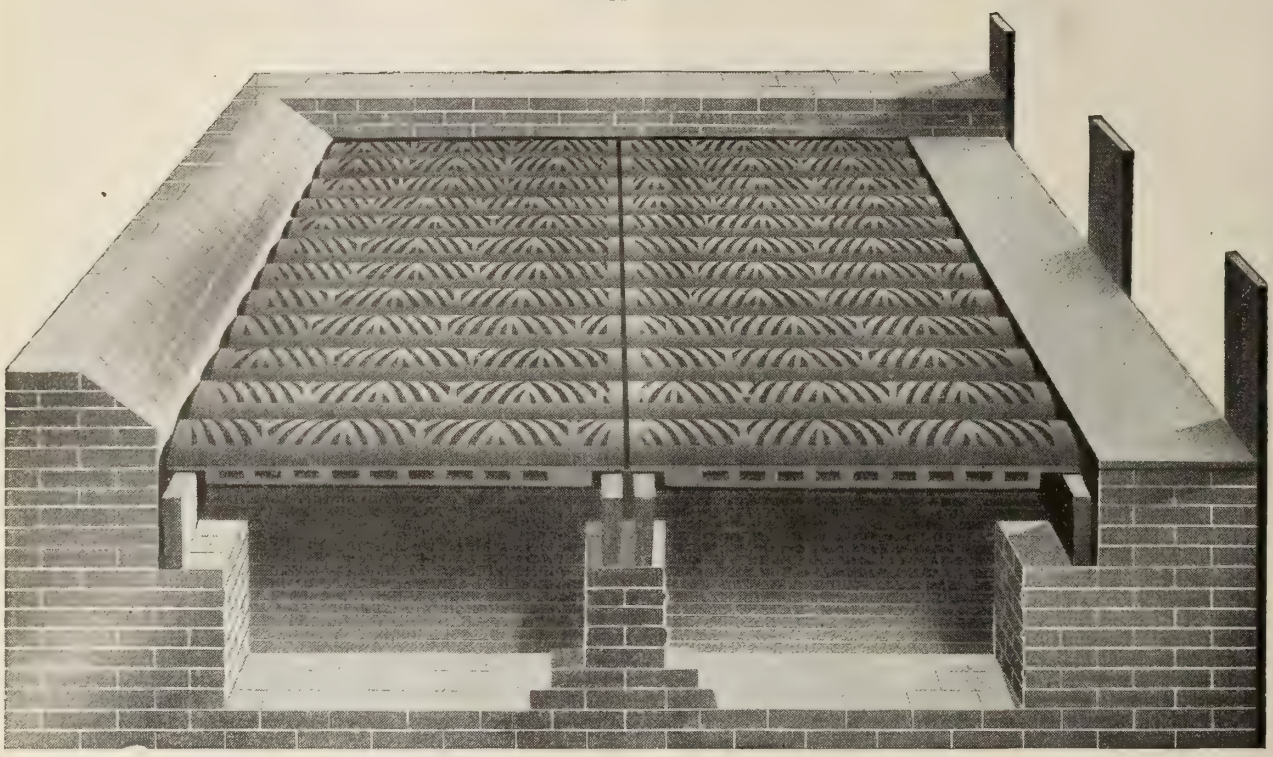
The John I. Thornycroft Co., London, Eng., Marine Motors.



THOMAS ELLIPTIC GRATE BARS

SHAKING—CIRCLE—STATIONARY

FOR EVERY FUEL



THOMAS IDEAS

PATENTED

THOMAS ELLIPTIC GRATE BARS	INCREASE STEAM—SAVE FUEL—SAVE LABOR —COST LESS—REDUCE SMOKE.
THOMAS GRATE RESTS	EVERLASTING — PRESERVE GRATE BARS— PROTECT FIRE WALLS.
THOMAS FURNACE SETTING	FIRE WALLS—BRIDGE WALL—FRONT WALL independent of all expanding and contracting irons. SEE THAT AIR SPACE COMPLETELY ENCIRCLING THE GRATE AREA. No dead and burned grate bar ends. No pushed down walls from expansion of grates.

Shipped from Hamilton, Ont. **Let us give you complete information.**

FOR ALL PROBLEMS

Steam—Grate Bar—Furnace—write THOMAS

The General Supply Co. of Canada, Ltd.

OTTAWA TORONTO WINNIPEG

THOMAS GRATE BAR CO., **Birmingham, Ala., U.S.A.**

"THE Cyclone"

Shaking and Dumping Grate Bar

The Cyclone is the grate you should instal because it has proved that it generates more steam from less fuel than any other.

To fire lightly gives the best results. The plan behind the Cyclone Grate is to enable the fireman to fire lightly and keep his fire free from ash.

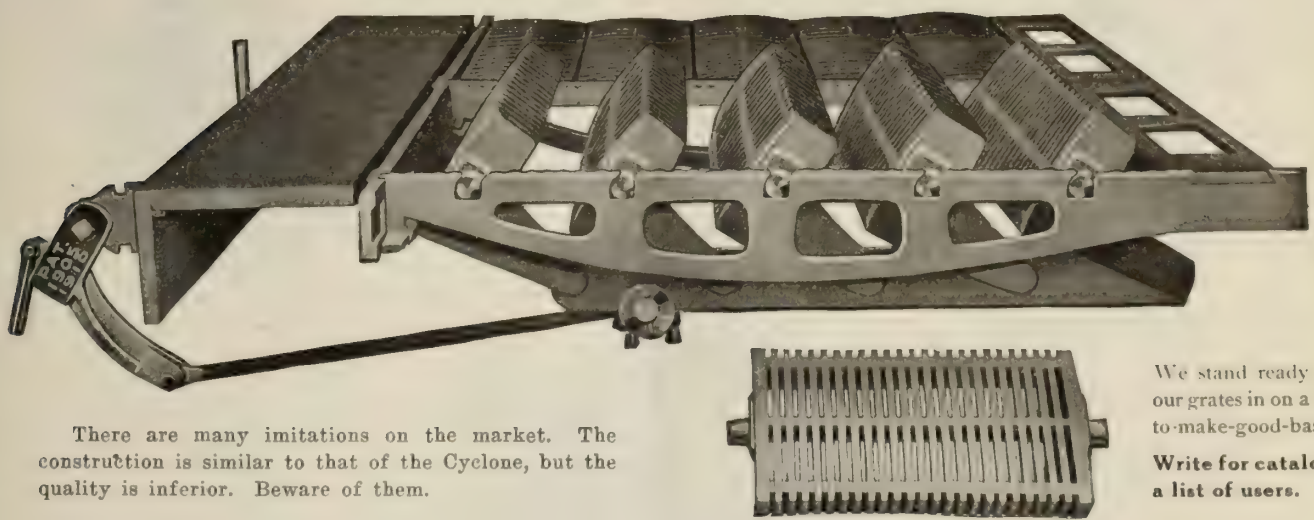
The **Improved Shaking Mechanism** means more vigorous and effective shaking, and prevents any ashes or clinckers clinging to the centre of the grate.

Burns the Cheapest Grades of Fuel with Results Equal to that of the Best

The Cyclone is the one Grate that locks level and cannot get out of adjustment or become warped. It allows 68 per cent. air space and 90 per cent. underdraft.

Easily and quickly installed; no shut down of plant is necessary. No expensive changes in brickwork needed.

The perfect balance makes shaking or dumping exceedingly easy.



There are many imitations on the market. The construction is similar to that of the Cyclone, but the quality is inferior. Beware of them.

We stand ready to put our grates in on a "have-to-make-good-basis."

Write for catalog and a list of users.

The Canadian Steam Boiler Equipment Co., Limited

SOLE MANUFACTURERS FOR CANADA

211 QUEEN STREET EAST :-: :-: :-: **TORONTO, CANADA**

AGENTS

ST. JOHN, N.B., F. W. Blizard, Canada Permanent Chambers. MONTREAL, H. L. Peiler & Co., 308 St. James Street.
HAMILTON, Robt. Fitzsimmons, 8 Grove Street. CALGARY, Alta., The Western Foundry & Metal Co., Limited.
BERLIN, J. Hainsworth, 14 Foundry Street. WINNIPEG, Vulcan Iron Works.

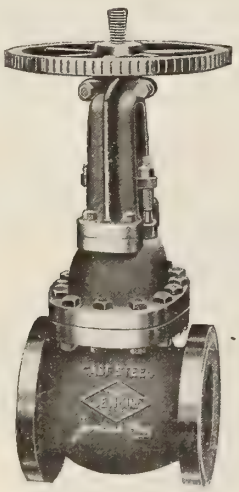
TRADE JENKINS MARK

Jenkins Bros.

JENKINS BROS'. VALVES FOR HIGH PRESSURE SUPERHEATED STEAM

For high pressure superheated steam our Extra Heavy Pattern Globe, Angle, Cross or Check and Extra Heavy Gate Valves are made with bodies and bonnets of cast steel, having a tensile strength of 68,000 to 70,000 lbs.

The seat rings, discs and spindles are made of Monel Metal. This is a natural alloy, containing about 70 per cent. nickel. In addition to being very hard, durable and non-corrosive, it has the same co-efficient of expansion as the cast steel, thus providing a combination which experience has proved to be best adapted to withstand the destructive effects of the sudden and frequent wide variations in temperature which usually accompany the use of superheated steam. All connecting flanges are made with 1-32 in. raised faces inside of bolt holes, and approved high pressure gaskets or ground joints, as may be specified.

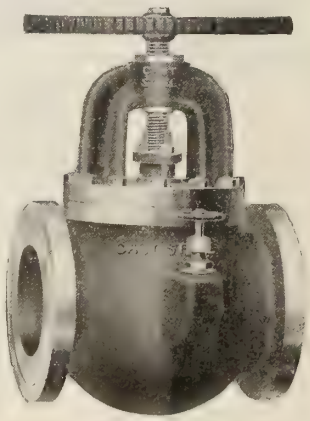


Outside Screw and Yoke Gate Valve. Fig. 388

Bolt holes are always spot-faced unless otherwise specified on order. The valves are suitable for working steam pressures up to 350 pounds and total temperature of 800 deg. F.

Angle. Fig. 382

Our "Diamond" Trade Mark is cast on the body of all Genuine valves for your protection. Do not accept substitutes.



Globe with By Pass. Fig. 381

Most dealers stock our valves. If yours don't, write us for the name of the nearest one who does. Our catalog will be mailed to you free upon request.

JENKINS BROS. Limited

Branch at
95, Queen Victoria St. E.C., LONDON, ENG.

Head Office and Works
103 St. Remi St., MONTREAL

DART UNION PIPE COUPLINGS

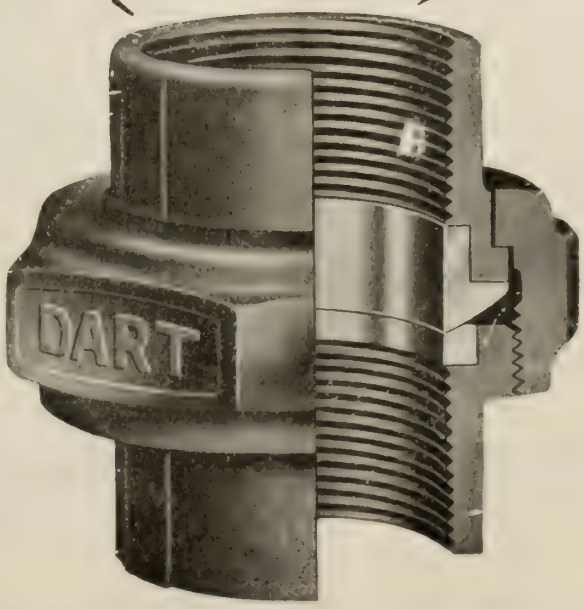
Make Joints That Never Leak, Rust or Corrode

Pipes are easily connected with "Dart" coupling whether they are in or out of line.

The coupling is never affected by contraction, expansion or vibration.

Always look for the Trade Mark (Dart)—it is cast on all Dart Unions. We replace two for one every Dart Union found defective.

Buy Dart couplings from your own dealer.



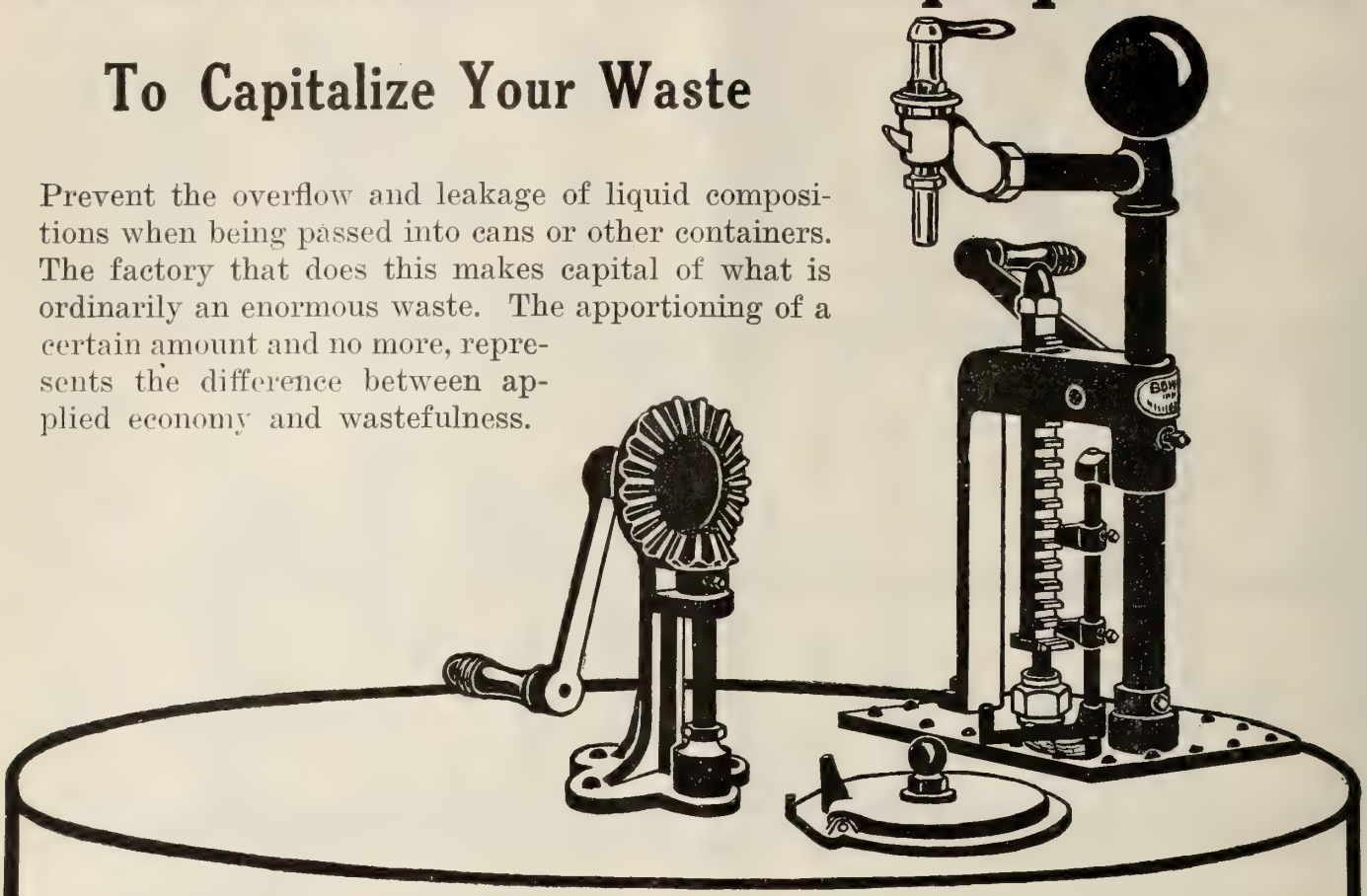
Bronze to Bronze at the Joint

Dart Union Co., Limited
TORONTO, CAN.

Modernize Your Equipments

To Capitalize Your Waste

Prevent the overflow and leakage of liquid compositions when being passed into cans or other containers. The factory that does this makes capital of what is ordinarily an enormous waste. The apportioning of a certain amount and no more, represents the difference between applied economy and wastefulness.



The Bowser Self-measuring Outfit with Agitator

regulates the supply from a gill to a quart, according to the exact requirement. Not a drop of waste liquid can be seen around a Bowser Outfit. In fact, it is the dearth of the drops that assures the prize in the profits.

The pump attached to the tank can be regulated to fill any sized container with capacity not exceeding one quart. For larger containers special equipment is provided. An indicator in connection with a quantity dial is utilized in making the different measurements. The agitator can be driven by hand or power.

Another outfit, essentially the same as this equipment, but with pump on the outside, is better adapted to the handling of liquids which are not to come in contact with the pump. Both outfits are thoroughly tested and inspected before shipment, to assure absolute accuracy and satisfaction.

It would be well to get into correspondence with us and let us prove to you just how much more profitable it is to convert an enormous waste into a tremendous saving than to absorb it onto the mop or into the atmosphere. We'll send full details. Let us hear from you to-day.

S. F. BOWSER & CO., Inc.

66-68 Frazer Ave. **Toronto, Ont., Canada**

MADE BY CANADIAN WORKMAN AND SOLD BY CANADIAN SALESMEN

Sales Offices in all centres and Representatives everywhere

Original patentees and manufacturers of standard, self measuring, hand and power-driven pumps, large and small tanks, gasolene and oil storage and distributing systems, self-registering pipe line measures, oil filtering and circulating systems, dry cleaner's systems, etc.

Established 1885.

Perolin

The German Boiler Metal Preservative

WARRANTY

We Guarantee PEROLIN the German Boiler Metal Treatment.

1. To remove scale already formed in your boilers.
2. To prevent new scale from forming.
3. To Stop all pitting, Corroding and galvanic action.
4. Not to corrode or injure the boiler metal or packing.
5. Not to effect or impart any off-odor to steam generated from the water.
6. To correct oil troubles caused by oil or grease getting into boiler water.
7. Not to affect the product of Breweries, Ice Plants, Creameries, Dye Works, or any Product where live steam is used in the manufacture of their goods.
8. That it does not affect the water, neither is it affected by the water and that the Perolin Preservative Film is a good transmitter of heat.

IS NOT A "BOILER COMPOUND"

because it has no action on the water. PEROLIN as a preliminary operation, mechanically removes scale accumulated in the boiler, but its chief work is

The Prevention of Further Scale Formation

which is accomplished by establishing on the boiler metal Perolin preservative film—a good transmitter of heat—and therefore

PEROLIN

Prevents Pitting
Corrosion
Galvanic Action
and solves all boiler troubles.

Used in over 30,000 boilers in United States.
Used in Europe and England 18 years.
Used by many leading Canadian firms.

TRY "PEROLIN" AT OUR EXPENSE—AND BE CONVINCED.

Write To-Day For Particulars.

Perolin Company of Canada Limited
Standard Bank Building - - Toronto

The advertiser would like to know where you saw his advertisemen. -tell him.

Stop Blow-outs and Leaks in Pipe Lines by Using GOETZE No. 2 ELASTIC GASKETS

If you start right now to renew with No. 2 ELASTIC GASKETS, you can steadily reduce your renewals until you have brought them almost to the vanishing point.

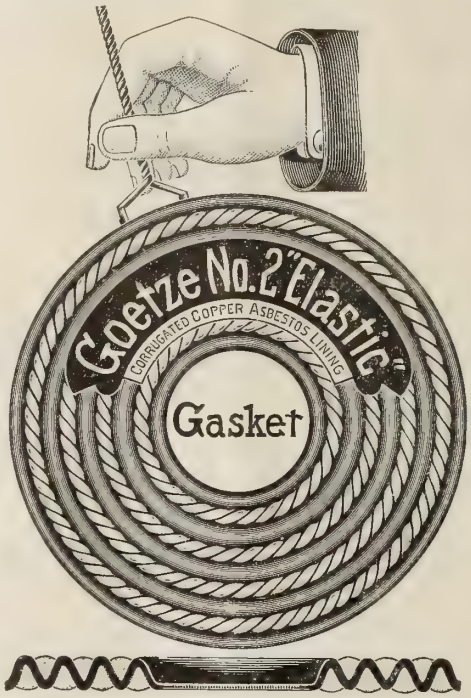
This is not a mere "claim"—it is backed up by a *guarantee*—in fact the strongest guarantee ever made by a gasket manufacturer.

Think what it means to re-gasket a joint so it will *keep tight for years,* instead of days or weeks. Think of the saving resulting in gasket costs, labor and shut-downs

What No. 2 Elastic Gaskets Will Do

No. 2 ELASTIC GASKETS will make the most troublesome joint you have absolutely tight — and keep it so. They "stay put" and stay tight. Prevent leaks, blow outs and shut-downs. Will practically eliminate renewal expense for gaskets.

No. 2 ELASTIC GASKETS are for high pressure and super-heated steam lines, but owing to their indestructible nature, are equally adapted to *any and every condition* about a factory, mill or refinery.



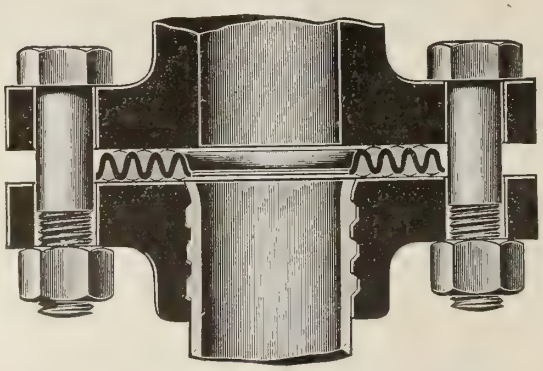
The No. 2 Elastic Guaranteed

Every No 2 Elastic Gasket is Guaranteed for 5 Years Continual Service in the Same Joint

There are no "ifs and ands" about this guarantee. It means just what it says. It applies to every No. 2 GASKET whether bought direct from us or through a dealer.

How No. 2 Elastic Gaskets are Made

These Gaskets are made of corrugated copper with asbestos lining No. 2. The corrugations allow for expansion and contraction of the pipes, while the asbestos, being forced into the



pores of the metals in the flanged surface by the "squeeze" and the constant pressure of the corrugations beneath it, holds securely against the highest pressures.

Goetze Gaskets are carried in stock by

T. McAVITY & SONS, LIMITED

ST. JOHN, N.B.

MONTREAL
112 St. Peter Street

BRANCHES AT WINNIPEG
C. E. Chown, 147 Bannatyne Street

VANCOUVER
c/o A. O. Campbell, 1069 Hamilton Street,

MANUFACTURED BY

Goetze Gasket & Packing Co., New Brunswick, N.J.

The advertiser would like to know where you saw his advertisement—tell him.

A Well Lubricated Rod Means

Low Friction Load
Unworn Rods
Long Service from Packing

"PALMETTO"

keeps the rod thoroughly lubricated, as each single strand of which it is made acts as a separate reservoir of graphite grease lubricant.

That is why "Palmetto" gives much longer and more satisfactory service than any other packing.

Send for a free working sample; it will show you what a well lubricated packing will do.

GREENE, TWEED & CO.

Sole Manufacturers

109 Duane Street **NEW YORK**

CANADIAN DISTRIBUTING AGENTS:

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED,

Montreal, Ottawa, Toronto, St. John, Winnipeg, Calgary, Saskatoon, Victoria, Vancouver

The advertiser would like to know where you saw his advertisement—tell him.

INTERESTING FIGURES
BY A
FAMOUS ENGINEER

Professor Robert H. Smith, of England, a distinguished Mechanical Engineer, Knighted for his scientific attainments, etc., recently had occasion to make a careful test of MAGNOLIA METAL, and we give below extracts from his report:

> "Each bearing was run for some hours under moderate load and with oil lubrication in order to rub it down to a good fit upon the journal. It was then well cleaned out, and the measured friction tests were run with **water lubrication** and cooling only. This appears to be the only satisfactory method of comparative testing of bearing metals, because the influence of small differences in quality and quantity of oil is so great as to mask to a large degree that of differences in the metals. The use of water also admits of the quantity of heat generated being measured with approximate accuracy."

Further on in his report he says:

> "This (Water) test proves that Magnolia Metal can be easily **run continuously** at over 130 lbs. per square inch load at from 400 to 450 r.p.m., with a co-efficient of friction varying from .05 to .07 **with water lubrication.**"

Here we have a positive statement by perhaps the greatest living authority on such subjects that Magnolia Metal can be run continuously at certain loads and speeds independent of oil lubrication.

SOLD BY LEADING DEALERS EVERYWHERE OR BY

MAGNOLIA METAL CO.

OFFICE AND FACTORY:

225 St. Ambroise St. **MONTREAL**

"The Muslin Wrapping Keeps Grit and Dirt off the Packing"

Many a scored or worn rod is the result of lack of care in handling the packing. On account of its being exposed dirt and grit work their way into the fabric of the packing and act on the rod much as would sand paper or emery cloth.

Every effort is made to place our packing in your hands in the same perfect condition in which it leaves the factory. When furnished in **coil** form, we not only use strong boxes but, as an extra precaution, wrap the packing with muslin.

DANIEL'S ROD PACKING P. P. P. COIL RING SPIRAL

This is the way an expert describes our packings: "Daniel's P. P. P. Rod Packing consists of two wedges and a cushion, held together with a braided jacket."

"The cushions of the several styles of P. P. P. are made of materials peculiarly adapted to the service for which each style is intended. The wedges are so shaped and arranged that they will freely slide on each other, and automatically increase or decrease the pressure on the rod as the steam pressure varies in the cylinder."

"All styles of P. P. P. Rod Packing are prepared with the most approved lubricants, which enamel the rod, fill in scores, if any, and allow the rod to work freely, thereby preventing heating or binding."

P. P. P. Holds Against 560,000 Pounds Pressure.

A Chicago Chief Engineer writes: "I have used Daniel's P. P. P. Rod Packing for over five years, and have always had good results. I now have our hydraulic pump packed on both steam and water piston rods; the water end working against 280 tons gauge pressure for over two months without having to put in any fresh packing, and it is as tight as when I first packed it. I have it on several other pumps, with the same results."

How to Get the "Slide Valve" FREE

Fill out the Coupon, and mail it to us. We will address a book to you, and send it FREE of charge.

Your Name .....

Address .....

Employed by .....

Address .....

Horsepower of Engine .....

Kind of Rod Packing Used .....

Do You Use **EBONITE** Sheet Packing? .....

Dealer's Name .....

Address .....

Name of Buyer .....

.....Series 24-

Daniel's P. P. P. Rod Packing is imitated more than any other packing made. But the imitation is in appearance and claims only. None but the genuine gives the results.

QUAKER CITY RUBBER COMPANY

Manufacturers of Mechanical Rubber Goods

PHILADELPHIA, PA., U.S.A.

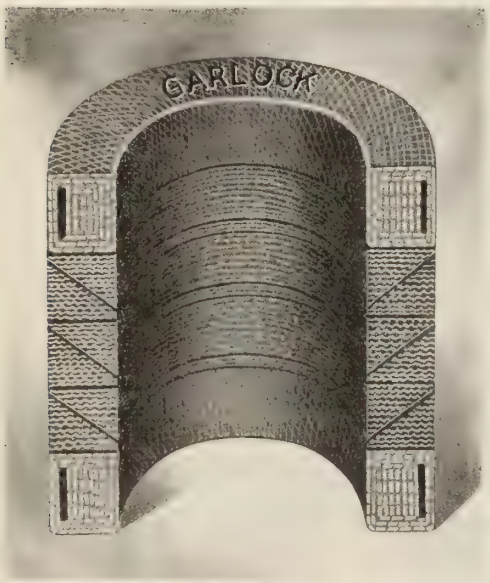
The advertiser would like to know where you saw his advertisement—tell him.

Garlock Packings

Fibrous and Metal Packing in all forms for service against any class of conditions.

You would not take headache tablets for stomachache. Don't expect ordinary packings to give you satisfactory results under severe or extraordinary conditions.

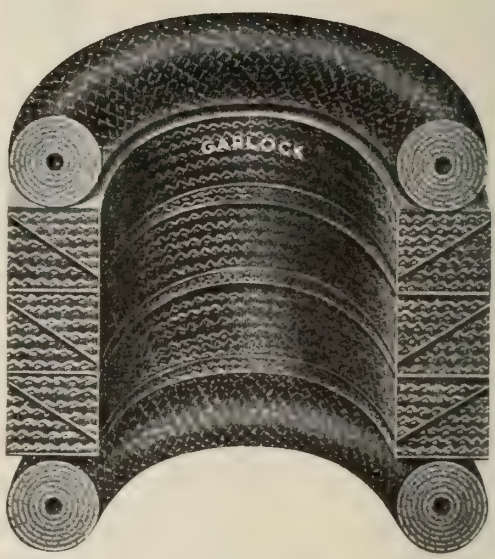
Garlock Duo Combinations



Style No. 447

are specially arranged and made from packings best adapted for the service under which they are to work.

If you have a difficult packing problem let us have a chance to prove that we can conquer it and give you results that will be perfectly satisfactory to you.



Style No. 446

"Garlock" stands for quality in packings. If you are not familiar with Garlock Packings drop us a card **to-day.**

The Garlock Packing Company

HAMILTON, ONTARIO

Montreal **Toronto** **Winnipeg**

Pioneers in the Packing Business

A Double Belt Pulley—Proved by Actual Tests--Lightest and Strongest

Flat "A" braced arms (edge on) give perfect rigidity and least air resistance.
Grooved air escape improves belt contact, yet the face is not weakened.
Rim: One thickness of steel. Snugly doweled at the joints Combines lightness with durability
Tight clamping hub eliminates key-way and set screw. Fits different shafts by use of interchangeable bushings, which are immovably fixed by interlocking device
Inside flange, to which ends of arms are riveted, secures extraordinary strength and trueness
No need to strip the shaft. Fit two halves of pulley together, then tighten clamping bolts evenly.
Arm rivets do not go through face, with possible protrusion of rivets.
Rolled bead on rim, strengthens face at edge.

EVERY new size or style of "American" Pulley must undergo, in our testing room, a trial much more severe than it could meet under ordinary working conditions.

"American" Steel Split Pulleys

Perfect in Principle Powerful in Performance

are compared, in our testing room, with corresponding sizes of other pulleys. If the "American" does not show up *better* than the others, *it is not good enough*, and the model must be improved.

In this way we have proved, conclusively, that "American" pulleys will stand up under greater strain than other pulleys, even those having much more weight. Correctness of design makes the "American" true and balanced.

We have sold over 2,000,000 "American" Pulleys. Less than 2-10 of one per cent. have been reported as failing to fulfill our guarantee of double belt service under any conditions, not requiring a special pulley.

Send for "Factors of Energy"—a little, useful booklet giving information and tables that every millman should have.

THE AMERICAN PULLEY COMPANY

OFFICE AND WORKS, PHILADELPHIA, PA., U.S.A.

Large stocks of "American" Steel Split Pulleys are carried at the following warehouses, insuring prompt shipment to customers.

CANADIAN DEALERS:—Williams & Wilson, Limited, Montreal, Quebec; A. R. Williams Machinery Co., Limited, Toronto, Ont.; St. John, N.B.; Winnipeg, Man.; Calgary, Alberta; Vancouver, B. C.

Use Stephenson Bar Belt Dressing

Make 1913 a record breaking year. Turn over a new leaf and get rid of the things that have been causing needless trouble and expense. Adopt the things which will make your work easier, give better results and save money for your employer. You cannot start at a better place than with your belt dressing.

Get rid of your troublesome liquid dressing. Shake the can for the Stephenson solid stick and shake trouble at the same time.

Stephenson Bar Belt Dressing is a friend in need. It doesn't require preparation, nor do you have to use special care in applying it. The minute the belt slips you hold the Stephenson bar to the belt for a few seconds and the slipping stops. There's no waste—no slop—no smearing on of paste or pouring on of spattering liquid. And the results are better.

I'll **"Stick to the Solid Stick"**

Start With a Free ½ Lb. Sample

Simply send us your name and address and we ll send you a present in the shape of a free half-pound sample of Stephenson Bar Belt Dressing.

Remember—we give you this sample absolutely free of charge. Get this free half-pound of the finest belt dressing made and test it. Here's your chance to try somesomething really good at no expense.

None Genuine Without Trade-Mark

Stephenson Manufacturing Company

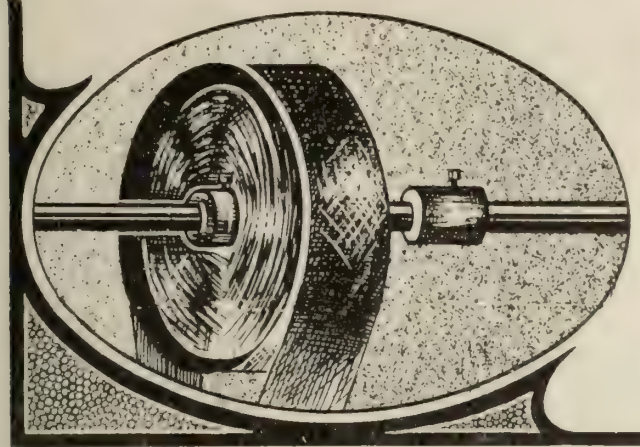
Est. 1888 Albany, N.Y. **Inc. 1897**

The advertiser would like to know where you saw his advertisement—tell him.

SPARTAN BELTING

Repeatedly Outwears Three Ordinary Belts—It's Not Affected by Steam, Water, Oil, Gas or Acid Fumes and Is Especially Adapted For Any Hard Service

For service under abnormal conditions where the life of the average belt is limited frequently to weeks, the Spartan has swept all before it, repeatedly outwearing three ordinary belts, obviating expensive shut-downs.



Spartan Belting, by its thousands of users, is conceded to be without an equal for successfully meeting the most exacting requirements.

Why not pick out one of those exacting or troublesome drives in your plant and let us prove to you the efficiency of the **Spartan Brand?** Anyhow let us send further particulars, together with copy of our Spartan Book. **Write to-day.**

1851 G & K TRADE MARK

The Graton & Knight Mfg. Co.

Oak Leather Tanners and Belt Makers,

Worcester, Mass., U.S.A.

Note: **There is a G & K belt for every drive.**

"Maple Leaf" Brand

Stitched Cotton Duck Belting

THE BEST FOR ALL KINDS OF BELTS

Means Reduced Upkeep Expense and Efficient Service

TO THE HARDWARE TRADE—

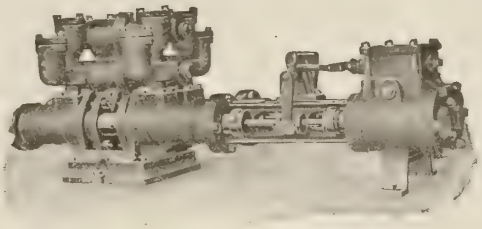
Look over your stock and send your orders in NOW for **"MAPLE LEAF" BELTING** and **BELT DRESSING,** so as to insure delivery within a reasonable time.

Ask us for further information and prices.

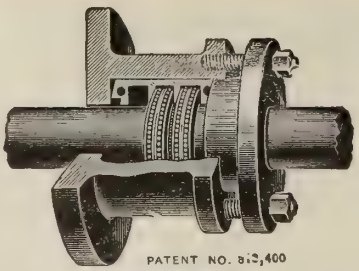
Dominion Belting Co., Ltd.,

HAMILTON, CANADA

WE MANUFACTURE ALL KINDS OF STEAM AND POWER PUMPS FOR ALL KINDS OF SERVICE.
THEY WILL NOT SHORT STOKE OR STOP.



The SMART-TURNER MACHINE CO., Limited
Hamilton Canada



PATENT NO. 8[illegible]2,400

PAT. NO. 436,177 " " 500,699 " " 534,104 " " 602,328

PAT. NO. 654,541 " " 654,542 " " 725,868

Why not Buy the Best, when in market for Packing?

HOLMES'
Metallic Packing
is Guaranteed 3 years

Lasts many times longer. 30 days trial. Less oil. No cutting. Easily applied to any Steam Engine, Air Compressor or Gas Engine. Satisfaction or no pay. Write us.

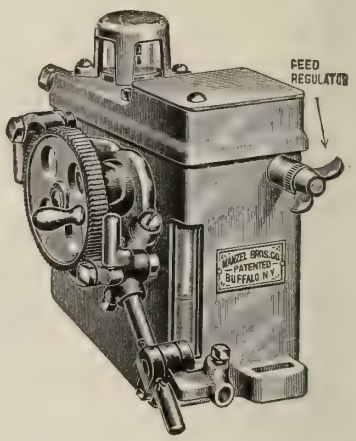
Holmes Metallic Packing Co., Wilkes-Barre, Pa.

Manzel Automatic Force and Sight Feed Oil Pump

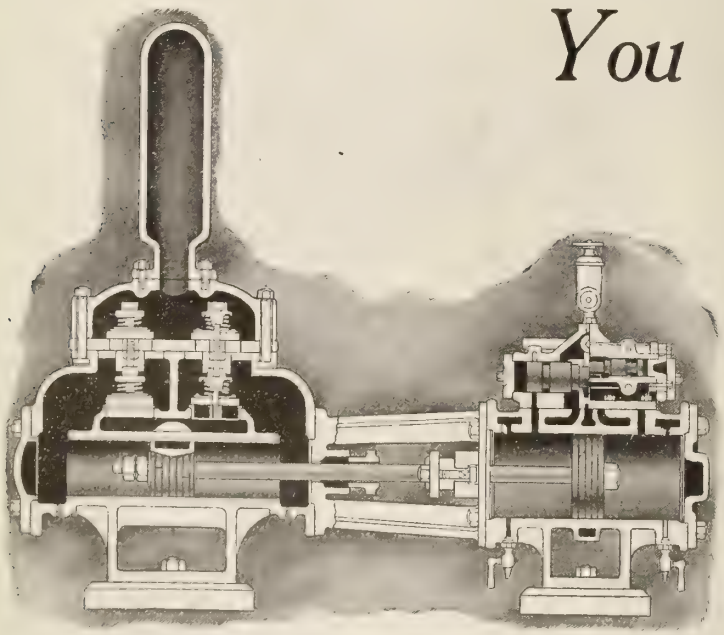
Guaranteed to Save 50 Per Cent. Of Your Oil

With this Pump Oil is fed into the Cylinder regularly, and positively all the time -no matter how slow the engine runs, what pressure the steam is carried, how high or low the temperature.
You can't afford to overlook this free trial offer.
Simply return the "Manzel" at our expense if not exactly as represented.
Write to-day.

Sent on 30 Days' Free Trial



The Twin City Oil Company General Agents for Canada Berlin, Ont.
Manzel Brothers Company, Buffalo, N.Y.



You Can Not Equal It For Simplicity

Never Needs Adjusting
Cannot Short Stroke
Uses Less Steam
No Packing in Steam End
Cannot Get Air Bound
Nothing to Get Out of Order
All Faces Machined

¶ "Bawden" Pumps are governed by piston valves which are controlled by the action of live steam only.
Simplicity throughout.
Greatest economy of steam consumption.
Valves, latest improved steam balanced type.
Guaranteed to make full stroke under constant or varying loads.

¶ The "Bawden" Pump provides the simplest, most economical and reliable means for feeding high or low pressure boilers.
Flexibility of speed obtained without any mechanical adjustment.
Automatic cushioning of piston and valves ensures greatest safety in any emergency.

SEND FOR CIRCULAR AND PRICES.

QUEBEC AGENTS: H. L. PEILER & CO., 380 St. James Street, MONTREAL

The Bawden Machine Co., Limited TORONTO CANADA

The advertiser would like to know where you saw his advertisement—tell him.

A busy paper mill making cheap steam without smoke or grits by the aid of "Bennis" machine stokers.

Cheap Steam for Industrial Undertakings

There are many Mills that are paying too much for their steam. With heavy fuel bills the boiler-duty is low and the boiler unable to respond rapidly to varying demands. Added to these troubles is that of a smoky and gritty chimney, the emission of smoke proclaiming imperfect combustion. "Bennis" Machine Stokers and Self-cleaning Compressed Air Furnaces reduce the coal bill, increase boiler-duty without detriment to the boiler, meet easily demands for rapid steam raising, maintain absolutely smokeless chimneys, and effect an all-round saving that makes their installation an investment.

A range of "Bennis" machine stokers increasing the steam output of water-tube boilers, and preserving boiler-life.

Write for **"Boiler-house Economy in Industrial Undertakings"** pamphlets, and full particulars to

GEO. H. TOD, 213 Manning Chambers, Queen St. W. **Toronto**
Winnipeg, 601 Union Bank Building

Marsh Steam Pump

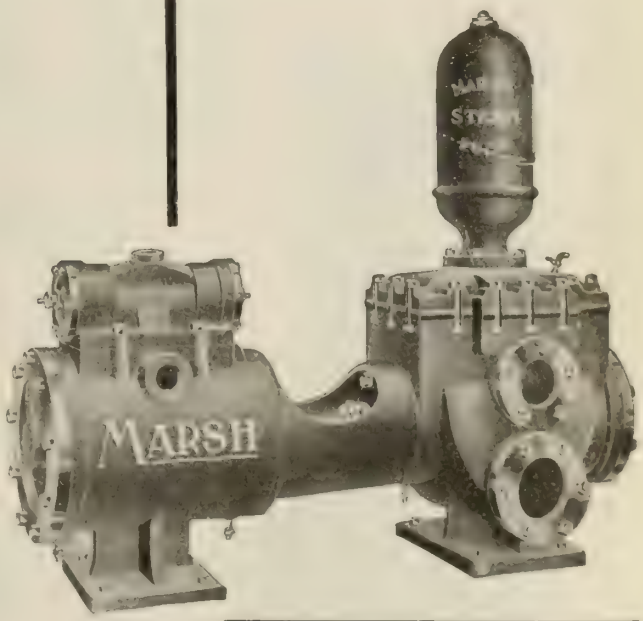
The Pump with the Self-governing Steam Valve

Note the extreme simplicity in construction and the absence of outside valve motion. There is practically nothing to get out of order. Nearly all the wearing parts are made of phosphor bronze instead of common brass, including piston rod, water cylinder lining and valve seats.

The steam valve is self-governing and admits only just enough steam to do the required work. The pump cannot short-stroke, race or pound under the most severe conditions.

115,000 in successful operation.

Ask for Catalog No. 18



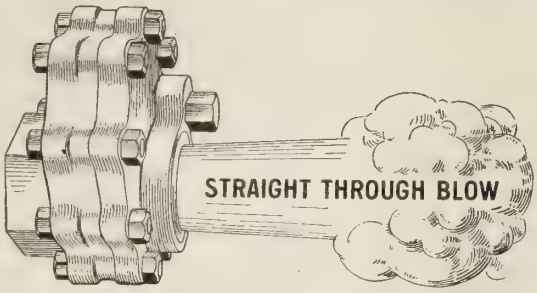
American Steam Pump Company
BATTLE CREEK, MICH.

CANADIAN AGENTS

A. R. Williams Machinery Co., Toronto
Williams & Wilson, Montreal
London Engines Supplies Co., London, Ont.
Stuart Machinery Co., Winnipeg
Hallman Machinery Co , Vancouver, B. C.
Mechanics' Supply Co., Quebec, Que.
Gorman, Clancey & Grindley, Limited
Edmonton & Calgary

The advertiser would like to know where you saw his advertisement—tell him.

EVERLASTING
BLOW-OFF VALVES



IT NEVER LEAKS!
WRITE FOR PRICES

200,000 IN USE

Does your Boiler leak, Mr. Engineer?
How often do you blow it?
The "EVERLASTING" is the only perfect blow off valve on the market.
No stuffing box—requires no packing—is self-cleaning, and has a self-grinding seat—nothing to get out of order—What's the answer?

RELIABILITY—SIMPLICITY.

SOLD AND MANUFACTURED UNDER CANADIAN PATENTS BY

Engineering Specialties Company, 1080 King St., West, TORONTO
LIMITED

AGENTS

MONTREAL, QUE.
H. L. Peiler & Co.

ST. JOHN, N.B.
The A. R. Williams Mach. Co.

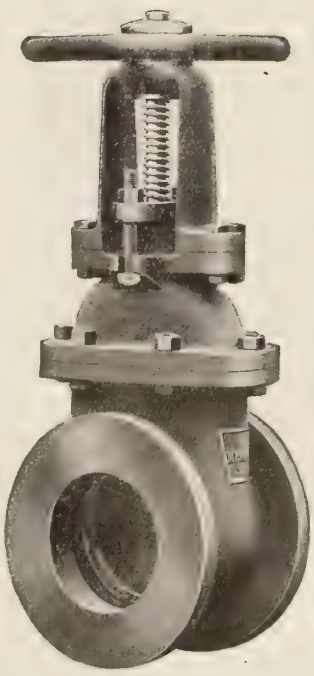
WINNIPEG, MAN.
The A. R. Williams Mach. Co.

CALGARY, ALTA.
P. D. McLaren Limited

VANCOUVER, B.C.
Taylor-Forbes Company, Limited

KERR GATE VALVES
OUTSIDE SCREW AND YOKE
"KEYSTONE" PATTERN

Embody all the latest features


4½-in. and larger

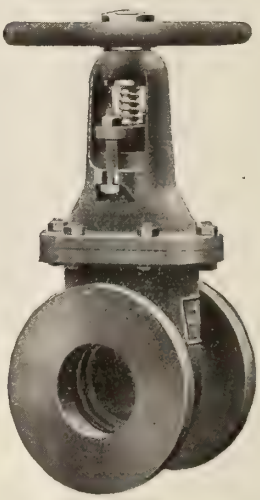
Screwed in Seats

Deep Bronze Bushed Gland and Stuffing Boxes.

Full Opening.

Large Diameter Hand-Wheels.

Solid Wedge Discs.


4-in. and smaller

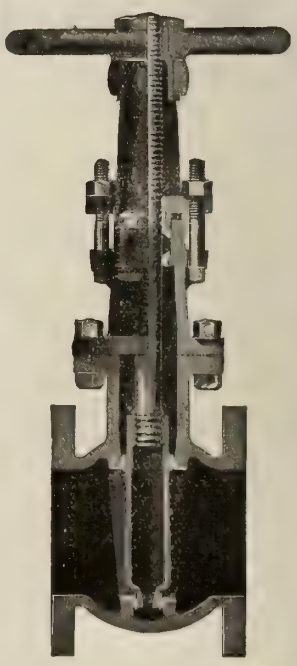
Narrow face-to-face Dimensions

Symmetrical Design.

Good Material.

Interchangeable Parts.

Guaranteed Tested.


4½-in and larger

The Kerr Engine Co., Limited, MANUFACTURERS
Walkerville, Ontario

The advertiser would like to know where you saw his advertisement—tell him.

Iron Body
Spring Encased

LUNKENHEIMER POP SAFETY VALVES

These valves are **economical** because they will **relieve only enough steam to reduce excessive pressures.** They can be positively relied upon to operate **promptly** and will not chatter or pound themselves to pieces.

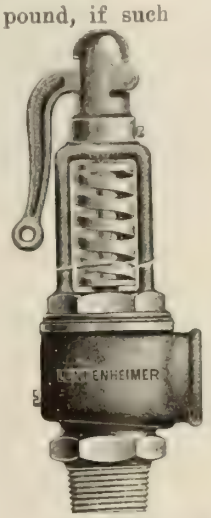
They can be regulated to reduce the pressure only one pound, if such close regulation should be desired, and adjustment of the pop and pressure can be made from the outside of the valve.

All parts subjected to wear are renewable. Either **Brass** or **Iron Body Valves** can be had, with incased spring or spring exposed.

For durability and reliability, **LUNKENHEIMER POP VALVES** have no equal.

Specify and insist upon having genuine **Lunkenheimer make.** Do not accept substitutes—they are never as good as the genuine.

Your local dealer can furnish them; if not, write us. Write for catalogue.



Brass Body
Spring Exposed

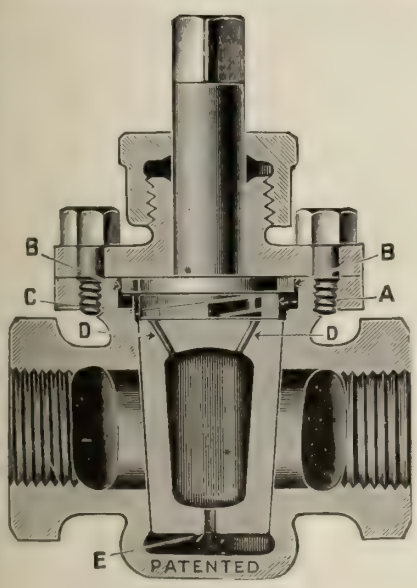
4-43

THE LUNKENHEIMER COMPANY

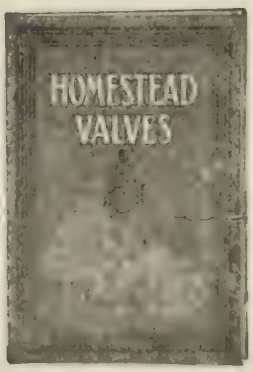
Largest Manufacturers of High Grade Engineering Specialties in the World.

General Offices and Works: CINCINNATI, OHIO, U. S. A.

New York, 64-68 Fulton St. | Chicago, 186 N. Dearborn St. | Boston, 138 High St. | London, S. E. 35 Great Dover St.



The Valve —and The Book



Here is a book which tells about THE valve for your most difficult service.

By Protecting the Seat We've Made

HOMESTEAD VALVES

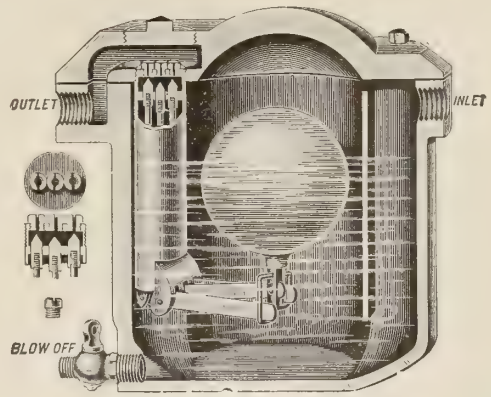
Practically Wear-Proof

Furthermore, the plug is balanced and held in place by the pressure when open, and when closed it is locked in the seat by our patent wedging cam, insuring freedom from friction in seat while the plug is turning. This makes the Homestead the quickest acting, simplest made, easiest operated, and most durable valve known.

Write for Catalog "R"

Homestead Valve Manufacturing Company

Pittsburgh, Pa., U.S.A.



Wright
"Emergency" High Pressure Continual Flow Steam Trap

THREE VALVES

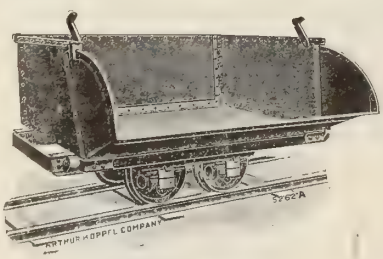
GREAT CAPACITY

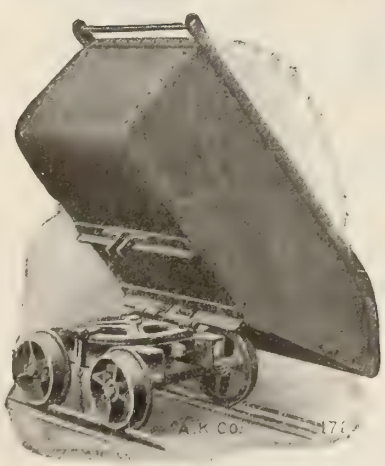
Keeps the steam line automatically and continually drained of accumulating condensation.
Shipped subject to trial and return if results are not satisfactory.
Send for Catalog.

DARLING BROS., Limited

15 Ottawa Street, MONTREAL

TORONTO WINNIPEG ST. JOHN, N.B.





A VERY satisfactory type of car for use in hauling ashes, dirt, etc., is the Scoop Car, which can be dumped either between the rails or to either side. Standard capacities are 12, 18 or 27 cubic feet for gauges of 18 or 24 inches.

How to Charge Furnaces Economically

A very important factor in the problem of keeping a constant supply of power is that of how to stoke furnaces efficiently. We are selling agents for a system of conveying coal and for charging furnaces in boiler rooms which requires very little labor and is practically indestructible. This system consists of the well known Koppel Cast Plate Track and Charging Cars.

ORENSTEIN-ARTHUR KOPPEL

Coal Charging Cars for the conveying of coal to boiler rooms are made of steel and are very durable. They are light in weight and easy and convenient to operate, being designed with special reference to boiler room service. The height of the cars is such as to make shoveling very convenient for the stoker. They may be supplied either with two side doors or end doors, as desired, and with or without swiveling base.

The rails of the track used in our boiler room systems are cast integrally with solid sectional plates, which provide a level surface to walk upon while car is being propelled.

We have a very interesting catalogue on this subject, showing many installations of the Koppel System, together with illustrations of cars, track, switches, turntables, etc., which we should like to send you. Ask for catalogue 412.

SALES AGENTS

The Canadian Fairbanks-Morse Co., Limited

ST. JOHN QUEBEC OTTAWA MONTREAL
TORONTO WINNIPEG SASKATOON CALGARY VANCOUVER

The advertiser would like to know where you saw his advertisement—tell him.

MURPHY FURNACES

OCCASIONALLY we fail to get first contract; WHEN GET FIRST CONTRACT it is in but RARE INSTANCES WHEN DO NOT GET REPEAT ORDER—when additions are made to plant.

Illustrative of this: THE ST. LAWRENCE STARCH CO., Limited, Port Credit, Ont., bought Murphy Furnaces as follows:

1st order	March 1908	3 furnaces, 645 h.p.
2nd "	Feb. 1910	1 furnace, 215 h.p.
3rd "	June 1913	4 furnaces, 600 h.p.
3 contracts—in 5 years:		8 furnaces, 1460 h.p.

REPEAT ORDERS are the best evidence of merit!

For printed matter address:

MURPHY IRON WORKS, DETROIT, MICH. BUFFALO, N. Y.

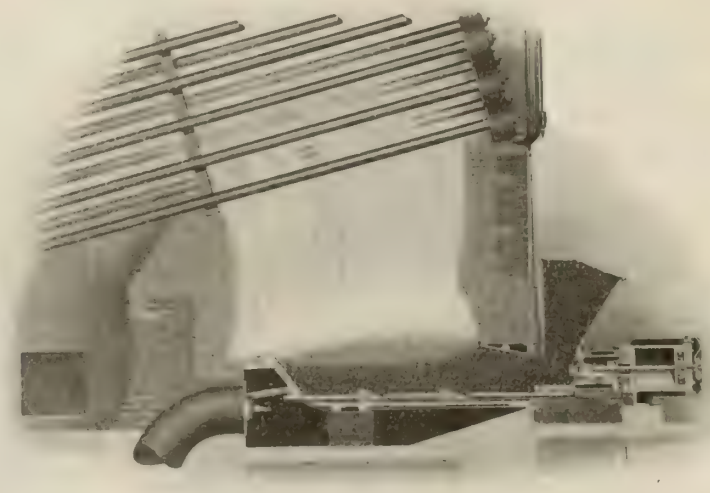
28 TIMES

They asked for more JONES STOKERS

In January, 1904, the Standard Oil Company placed their first order for

JONES STOKERS

In December, 1912, they placed their 29th order—covering a total equipment for 35,236 boiler H.P.



Why did the Standard Oil Co. repeat 28 times on Jones Stokers?

Why did the C.P.R. repeat 11 times for plants in Montreal, West Toronto, Winnipeg and Victoria?

Why did the E. B. Eddy Company repeat 8 times and the Halifax Electric Tramway Company 5 times?

Why, out of the last 60 orders for Jones Stokers, 47.1 per cent. were repeat orders?

The answer is in the stoker—efficiency and low repairs—the simplest mechanical stoker built. Has fewer parts, none of them exposed to action of fire. Simple and sure in operation—a labor saver, a fuel saver, a money maker in any plant, large or small.

JONES UNDERFEED STOKER CO., LIMITED

National Trust Building **Toronto, Ontario**

Across Canada

with the

IMPERIAL WIRE and CABLE COMPANY, LIMITED

Toronto MONTREAL Winnipeg

Third of a series of advertisements showing buildings of National importance which have been wired with the Imperial Wire and Cable Co.'s Limited wires.

This picture shows,

THE McARTHUR BUILDING, WINNIPEG

This building was wired with "30% PARA" Rubber Insulated Wire.

Architect .....J. H. G. Russell, Winnipeg
Engineer ..Charles L. Pillsbury, Minneapolis, Minn.
Electrical Contractors ..Mitchell-Gray Electric Co., Winnipeg.

Address enquiries to nearest office
MONTREAL TORONTO WINNIPEG

Enquiries from Alberta and British Columbia may be addressed to Northern Electric & Manufacturing Co., Limited, Calgary and Vancouver.

"ADANAC," "IMPERIAL HIGRADE" and "30% PARA."

Whether You Are Breaking 5 amps or 10,000 amps—

you will find that

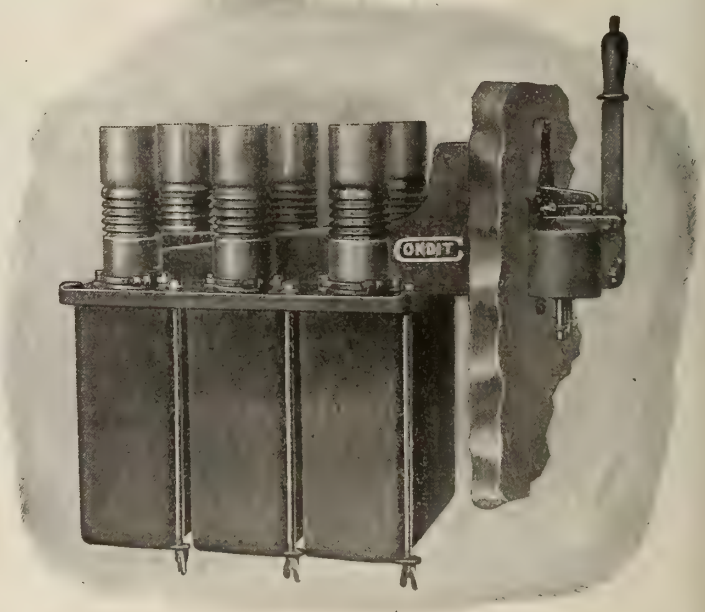
Condit Switches and Circuit Breakers

give absolute satisfaction.

Condit Switches and Circuit Breakers are not designed to open the circuit, but to **keep the circuit closed,** except in cases where an open circuit is necessary to protect valuable apparatus.

A special laminated brush gives Condit Circuit Breakers a wiping and self-cleaning action. This is a feature possessed by no other circuit breaker.

Furnished to meet any specifications up to 15,000 volts.



Conduit Circuit Breaker, Type D. F.
Write our nearest house for full information.
Exclusive Agents for Canada:

THE Northern Electric AND MANUFACTURING CO. LIMITED

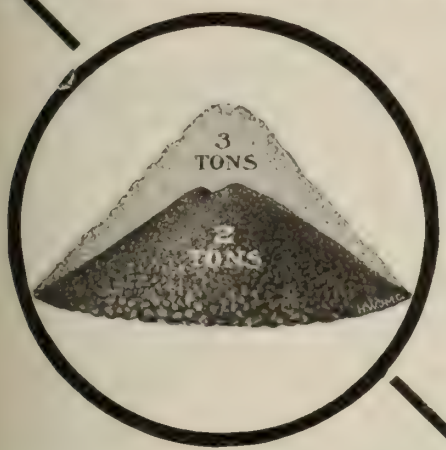
Montreal Halifax Toronto Winnipeg
Regina Calgary Edmonton Vancouver

It Acts on the Scale Itself

J-M Boiler Preservative gets right at the seat of boiler scale troubles. It doesn't depend upon any water analysis, but acts on the scale itself—removes it and prevents its formation. Its principle of action is direct—devoid of any round-about water-softening methods. When the iron is hot it attracts J-M Preservative like a magnet does steel. The preservative works through the cracks and along the metal under the scale, loosening the scale and causing it to drop off. It puts a film coating on the steel, which is an absolute conductor of heat, thus protecting the steel against corrosion and pitting, and preventing further formation of scale.

Boiler Scale

J-M BOILER PRESERVATIVE



effects a saving in fuel that is impossible with the more indirect methods. A mere ⅛-inch of scale wastes one-third of your fuel consumption—and not only that, it also wastes one-third of the feeder's energy. In other words, two boilers kept clean by J-M Boiler Preservative will do the work of three which are coated by ⅛ of an inch of scale. On every 100 tons of coal, at $3.00 per ton, you can therefore save $100 by doing away with the scale.

Write our nearest branch for booklet and further particulars

THE CANADIAN
H. W. JOHNS-MANVILLE CO., LIMITED

Manufacturers of Asbestos and Magnesia Products — TRADE ASBESTOS MARK — Asbestos Roofings, Packings, Electrical Supplies, Etc.

TORONTO MONTREAL WINNIPEG VANCOUVER

1637

"Crescent" Thermometers

AMONG the many styles and types of "Crescent" Thermometers may be found a complete line for Power Plants.

For accuracy, workmanship and appearance, the "Crescent" Thermometer has won for itself an enviable reputation. It has back of it over sixty years of experience in Thermometer making which is your assurance of Quality and Precision.

Our catalog is unusually comprehensive and mighty instructive. Send for a copy to-day.

Just say: Send Catalog W 27

The Schaeffer & Budenberg Mfg. Co.

BROOKLYN, N. Y.

Chicago **Pittsburgh**
New Orleans **Atlanta** **Washington**

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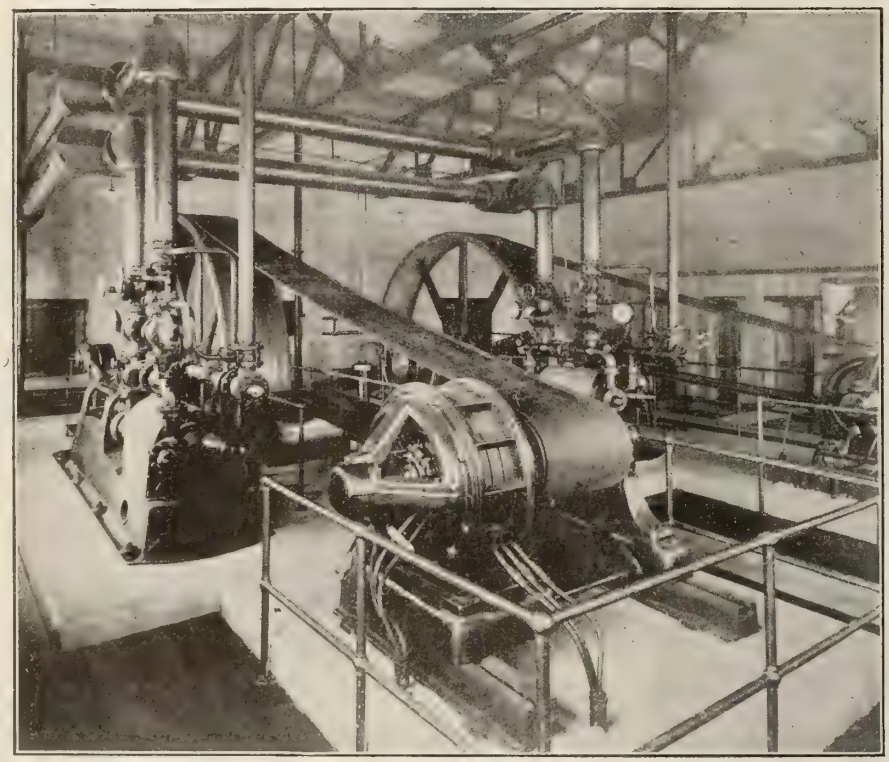
"THE LINDE"

REFRIGERATING and ICE-MAKING MACHINERY

CORK INSULATION

Over 8,000 Machines in use. Established and Manufacturing in Canada for 16 years.



Two 100-ton "Linde" Belt Drivers, Double Acting, Horizontal Ammonia Compressors Manufactured and Installed by us in Canada.

Recent Orders:—

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WM. CLARK, LTD., Montreal, Que.
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C.P.R. VANCOUVER HOTEL, Vancouver, B.C.
MATTHEWS-LAING, LTD., Fort William, Ont.
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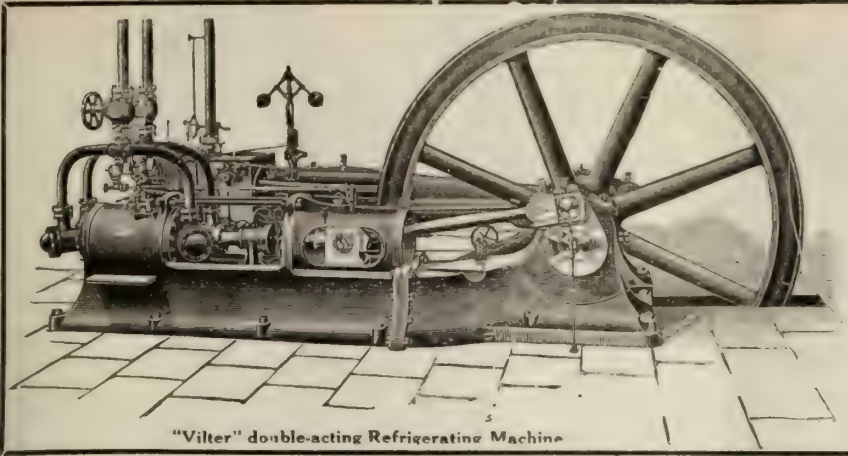
ST. THOMAS PACKING CO., St. Thomas, Ont.
MONTREAL GENERAL HOSPITAL, Montreal, P.Q.
OTTAWA UNIVERSITY, Ottawa, Ont.
WM. DAVIES CO., Winnipeg, Man.
CANADIAN NATIONAL EXHIBITION, Toronto, Ont.
McGILL UNIVERSITY, Montreal, P.Q.
G.T.P. FORT GARRY HOTEL, Winnipeg, Man.
C.P.R. ALGONQUIN HOTEL, St. Andrews, N.B.
AND MANY OTHERS.

The Linde Canadian Refrigeration Co.,

Limited

37 ST. PETER STREET, MONTREAL

Branch Offices—Toronto, Imperial Building, Adelaide St.; Winnipeg, 909½ Main Street; Vancouver, Anderson & Miskin, Imperial Block, Seymour and Pender Streets; Edmonton, Walker & Barnes, 562 Second Street; Calgary, General Supplies Limited, 1233 2nd Street East.



"Vilter" double-acting Refrigerating Machine

Established 1867

The VILTER MFG. CO.

242 Becher St. Milwaukee, Wis.

BUILDERS OF HIGH-GRADE

CORLISS ENGINES
ICE AND REFRIGERATING MACHINERY

any size and for any purpose, complete line Ammonia Fittings, Condensers, Brine Coolers, etc.

Write for Catalogue and full Particulars

The
LINDE BRITISH
Refrigeration Co. Limited

¶ Numerous fully authenticated laboratory tests organized from time to time in America and Europe, have invariably served to demonstrate in an unanswerable manner, the very remarkable degree of mechanical efficiency to which our products have been brought. *The history of mechanical refrigeration is our history.*

Head Office: LONDON, ENG.

BIRMINGHAM	GLASGOW	JOHANNESBURG, S.A.
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CORISTINE BLDG
MONTREAL

Self-Lubricating

In Cans
6, 12, 25 and 51 lbs.

SAFETY PLASTIC
METALLIC PACKING

FOR STEAM, WATER, AIR, GAS, ETC.
LASTS FOR YEARS AND NEVER WEARS THE PISTON ROD.

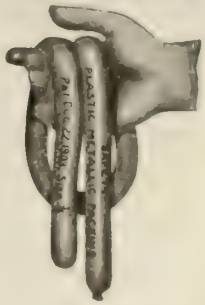
Guaranteed to stand steam temperature up to 550 degrees Fahr.
Guaranteed to stand hydraulic pressure to 5,000 pounds per square inch.
Packing furnished in bulk and in thin Cotton Tubes, sizes 3-16 to 1½ inch, 36 inches long, or in special lengths to fit your stuffing boxes.
Empty Cotton Tubing in assorted sizes FREE OF CHARGE with orders for the packing in bulk form.
The tubes are easily filled and they save you the expense of carrying a large stock of packings in different sizes.

Send for FREE SAMPLE and particulars.

Manufactured only by

STEEL MILL PACKING CO., WINDSOR, ONT.

Practically Frictionless



Any Quantity sent on APPROVAL

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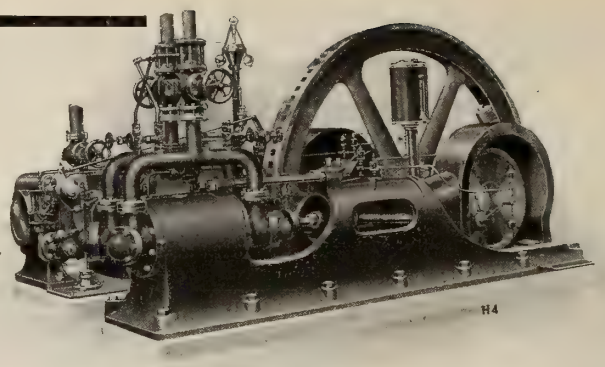


Refrigerating and Ice-Making Machinery and Equipment

is acknowledged the world over to have attained the highest degree of efficiency. For thirty-three years FRICK Machines have successfully endured the wear of exhaustive tests and proven all guarantees made.

It will pay YOU to KNOW US.

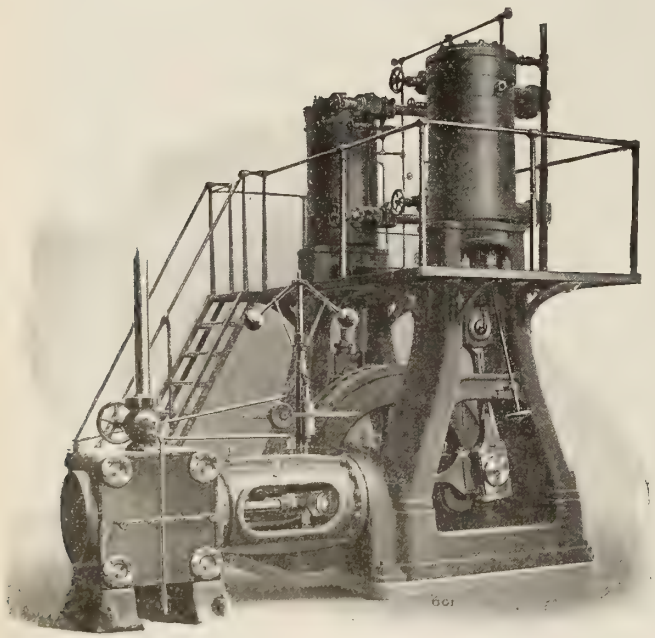
The FRICK is the only machine of which it can be said "There is no better machine built." The FRICK is durable—efficient and will last a lifetime.

We build all types of Refrigerating Machines—Vertical Single-acting, Horizontal Double-acting and Absorption.

WRITE FOR CATALOGUE TO

FRICK COMPANY, - Waynesboro, Pa., U.S.A.

NEW YORK CHICAGO SEATTLE PITTSBURGH CLEVELAND LOS ANGELES
ST. LOUIS DALLAS ATLANTA BALTIMORE BOSTON



Good Management Demands the Best

YORK REFRIGERATING MACHINES

Stand for

Efficiency Durability Economy

This is evidenced by the fact that many of the principal ice-making and cold storage plants are equipped with YORK Refrigerating machinery and apparatus.

The new fish freezing and storage plant just completed by the North Atlantic Fisheries, Port Hawkesbury, Nova Scotia, is equipped with York Machines and Refrigerating Apparatus.

For a plant requiring economy in operation, efficiency in power consumption and durability under hard service—install the YORK.

YORK MANUFACTURING COMPANY

Largest Manufacturers of Ice Making and Refrigerating Machinery in the World

Main Office and Works: YORK, Pa., U.S.A.

Represented in the Dominion by CANADIAN ICE MACHINE COMPANY

TORONTO, 163-167 Yonge Street **WINNIPEG, P.O. Box 336**

The advertiser would like to know where you saw his advertisement—tell him.

J. V. Jamison, President. T. B. South, Vice-President. J. V. Jamison, Jr., Treasurer.

THIS IS A CONTRACT

Looks Fair to Us. It is Fair

We invite users of Refrigerator Doors and Windows who are contemplating erection or remodeling plants to write us for

Sample Refrigerator Door and Frame Complete

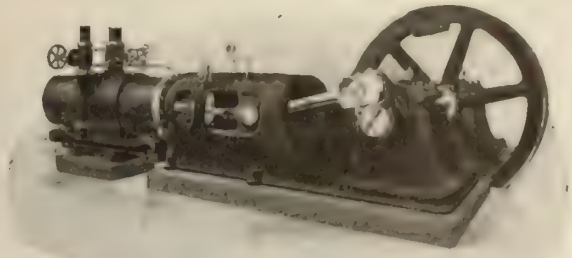
We will forward it to size required. If it is not satisfactory from every standpoint to *you* in style, workmanship, efficiency and plan, it is your property without charge or any obligation to us whatever. We feel justified in making the above offer, to show our foreign friends our good faith. We have no Agents, either here or in your great country, to exhibit and present our products. In this proposition we hope to prove that we merit your confidence.

Our patronage in Canada is very large and general. A few of the largest sales are to: —

Linde Canadian Refrig. Co.	Montreal, Can.
P. Burns & Co.	Calgary, Alta.
Swift Canadian Co.	Toronto, Ont.
Whyte Packing Co.	Brockville, Can.
Moose Jaw Cold Storage Co.	Moose Jaw, Sask.
Standard Milk Co.	Vancouver, B.C.
Edmonton City Dairy Co.	Edmonton, Alta.
Canadian Fish & C. S. Co.	Prince Rupert, B.C.

Jones Cold Store Door Co.

HAGERSTOWN, MD. U. S. A.



Arctic Electrically Driven

Ice plants are producing pure, crystal ice in cans, at a decreased cost for power and labor, and making a finer quality ice than the distilled water product.

This result is accomplished by installing our

Raw Water Ice Making Equipment

using the Arctic-Pownall System.

Any cheap motive power, such as water power, oil or gas engine, or electricity may be used.

Full particulars and printed matter will be mailed you — simply write us saying you are interested.

"We do it Right."

THE ARCTIC ICE MACHINE CO.

CANTON, OHIO, U.S.A.

Ice and Refrigerating Machines

THE COMING AMMONIA COMPRESSOR

THE "SAFETY"

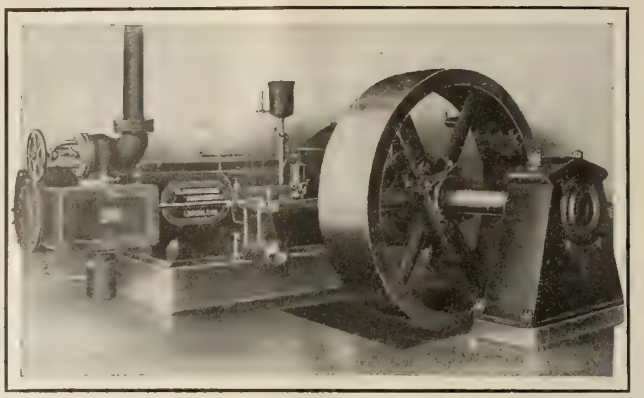
Built by

The HUETTEMAN & CRAMER CO.

DETROIT, MICH.

Complete Ice Making and Refrigerating Plants for every conceivable purpose.

SIX OF THESE "SAFETY" INSTALLATIONS TO DATE IN ONTARIO THIS SEASON



Side Crank Leonard Automatic Engines

Particularly adapted for Direct Dynamo Connection and Electric Light Service. Made in Simple and Compound Units up to 500 Horse Power. For High Economy and Close Regulation this engine is unexcelled.

We also make High and Slow Speed Corliss Engines for Heavy Duty Service. Our "Tangye" Engine is very well and favorably known throughout Canada for Sawmill Work.

MADE BY

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MANUFACTURERS OF

High and Slow Speed Engines of all kinds, Boilers, Heaters, Pumps, etc., etc., and complete Steam Plants.

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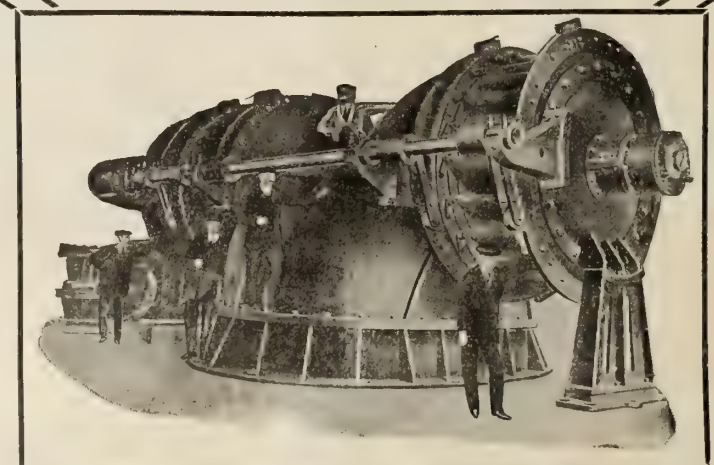
WATER TURBINES
—AND—
GOVERNORS

All Sizes

Maximum Efficiency



All Heads

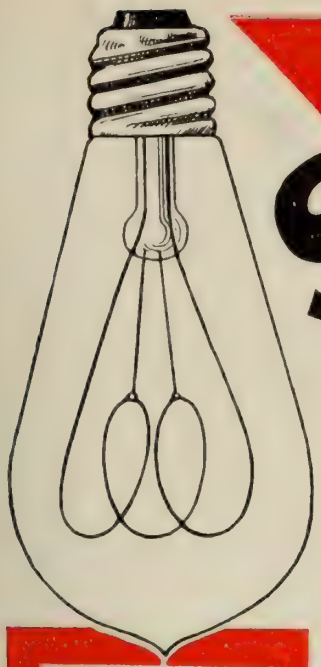
Ideal Control

ASK FOR PARTICULARS FROM

BOVING & CO. OF CANADA, LIMITED

164 BAY STREET, TORONTO.

Branch Office for British Columbia, 448 Seymour St., Vancouver



SUNBEAM Mazda

Vs. The Carbon Lamp

The Result

Sunbeam Mazda Drawn Wire Tungsten Lamp Gives Three Times The Light At Same Current Consumption.

Plant Lit With Ordinary Carbon Lamps

and besides it is assurance of **more** work and **better** work, because it enables the workman to be efficient.

The Sunbeam Mazda Tungsten Lamp is not affected by vibration—it is made to last—and does give **long** service.

It will be to the interest of **every** carbon lamp user to give Sunbeam a trial.

Absolutely guaranteed. **We ship quickly.**

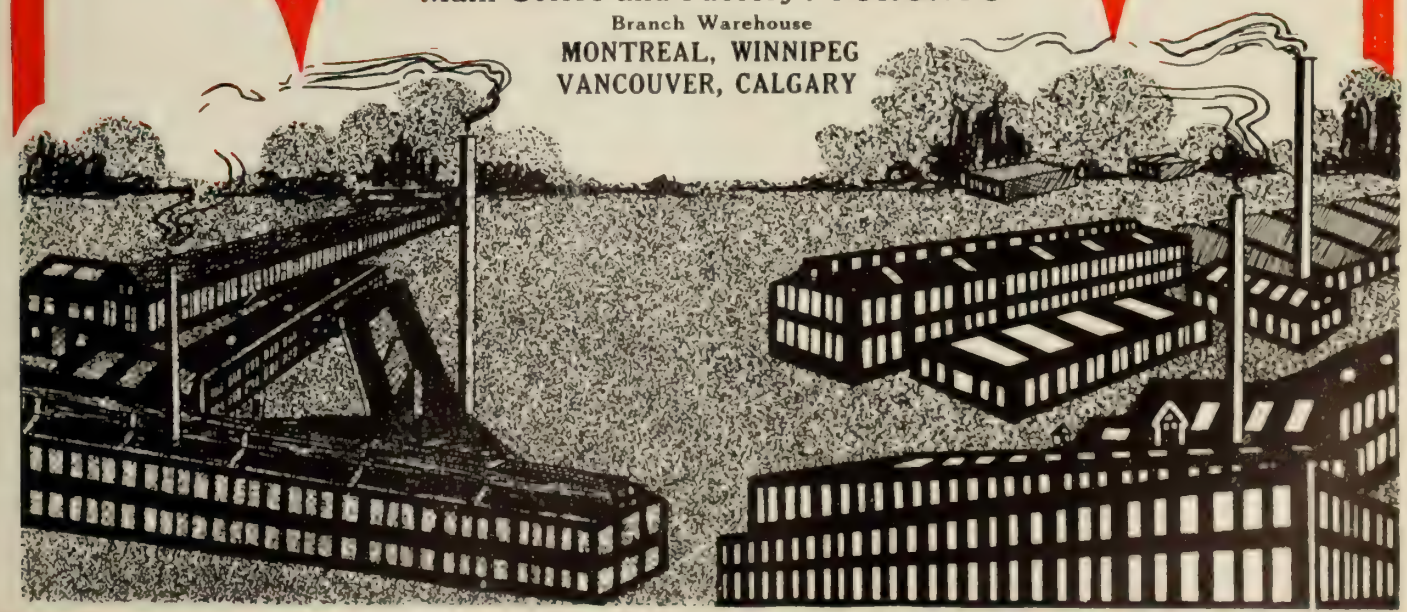
Plant Lit With Sunbeam Mazda Tungstens

The Canadian Sunbeam Lamp Co., Limited

Main Office and Factory: TORONTO

Branch Warehouse

MONTREAL, WINNIPEG
VANCOUVER, CALGARY



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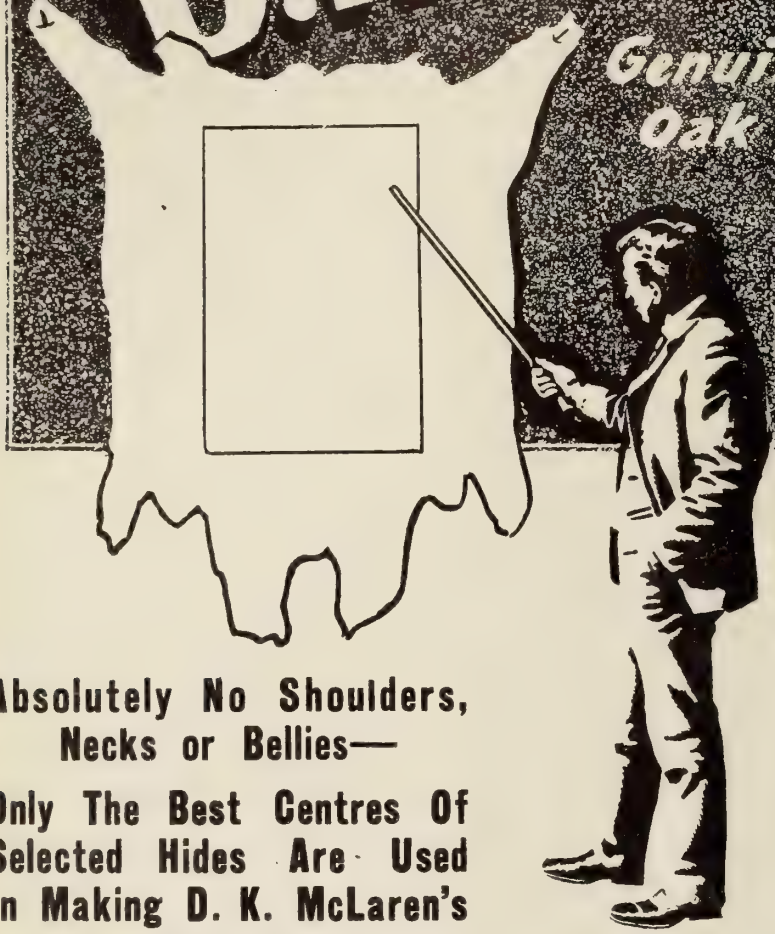
D.K.McLaren's

Genuine British Oak Tanned

LEATHER BELTING



Absolutely No Shoulders, Necks or Bellies—

Only The Best Centres Of Selected Hides Are Used In Making D. K. McLaren's Belting.

This Make Of Belting Is A Positive Assurance Of

Maximum Service

And A

Big Saving Of Money

The best of everything goes into this belting—the best centres of the choicest hides—**the real British Oak Slow Method of Tanning** —and the work of expert belt makers.

The complete manufacturing process is under our personal supervision.

A Guarantee that is on every piece of D. K. McLaren High Grade Belting

D. K. McLaren's Belting assures maximum service because it is of great strength and durability — and a big saving of money because it does not have to be replaced as quickly as other belts or require near as much attention, as there is practically no stretch.

It will be much to your interest to try one of D. K. McLaren's Belts now.

D. K. McLAREN Limited

Montreal 351 St. James St.

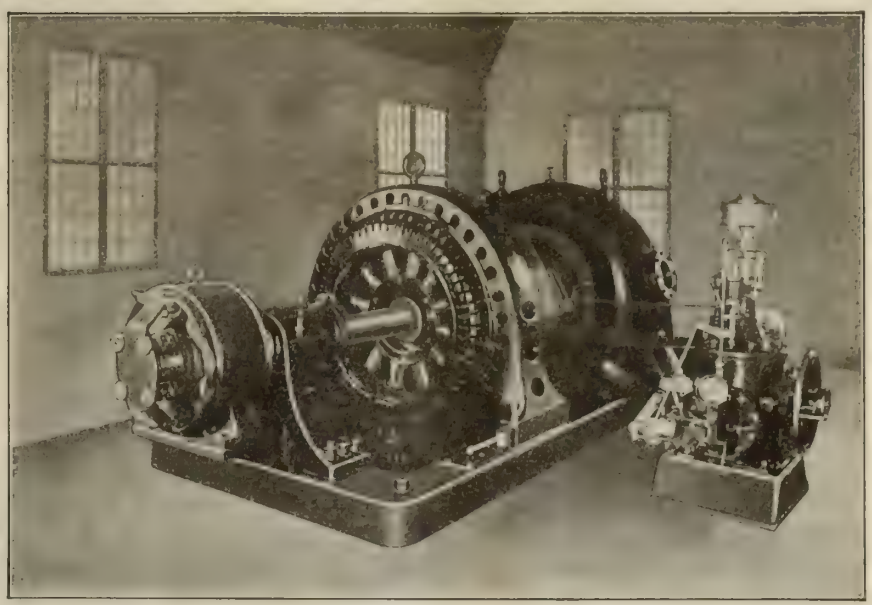
Toronto 200 King St. W.

Vancouver 37 Alexander St

St. John, N.B. 64 Prince William St.

Hydraulic Turbines

Specially designed and built for connection with Electric Generators.



Single Horizontal Turbine and Governor

360 H. P. **600 R. P. M.** **100 Ft. Head**

CANADIAN ALLIS-CHALMERS, LIMITED

Head Office:—KING AND SIMCOE STREETS, TORONTO

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MONTREAL HALIFAX OTTAWA COBALT PORCUPINE FORT WILLIAM WINNIPEG REGINA SASKATOON CALGARY EDMONTON NELSON VICTORIA VANCOUVER PRINCE RUPERT

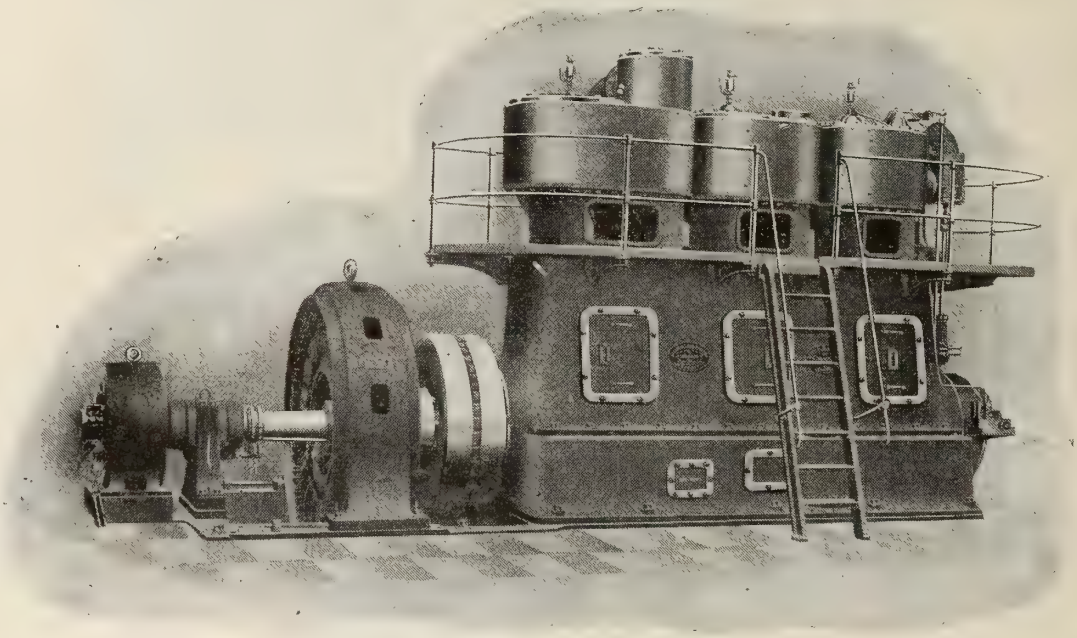
Manufacturers of:—Air Compressors, Boilers, Cement Making Machinery, Concrete Mixers, Flour Mill Machinery, Gas Engines, Hoisting Engines, Hydraulic Machinery, Ornamental Metal Work, Rock Crushers, Rock Drills, Saw Mill Machinery, Steam Pumps, Steam Specialties, Steam Turbines, Structural Steel, Transmission Machinery, Turbine Pumps, Water Wheels.

The "Browett-Lindley"

Quick Revolution, Forced Lubrication, Double Acting Steam Engines

Simple ***Efficient*** ***Economical***

These engines have established a high reputation in electric light and tramway plants, collieries, cotton and paper mills, steel and iron works, etc., and are made in five different styles to suit steam pressure and working conditions.



Three-crank, Triple Expansion, "Browett-Lindley" Engine driving 500 K.W. Generator.

Sole Agents for Canada:

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., Limited

Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

Works: Seigneurs & Williams Streets, MONTREAL.

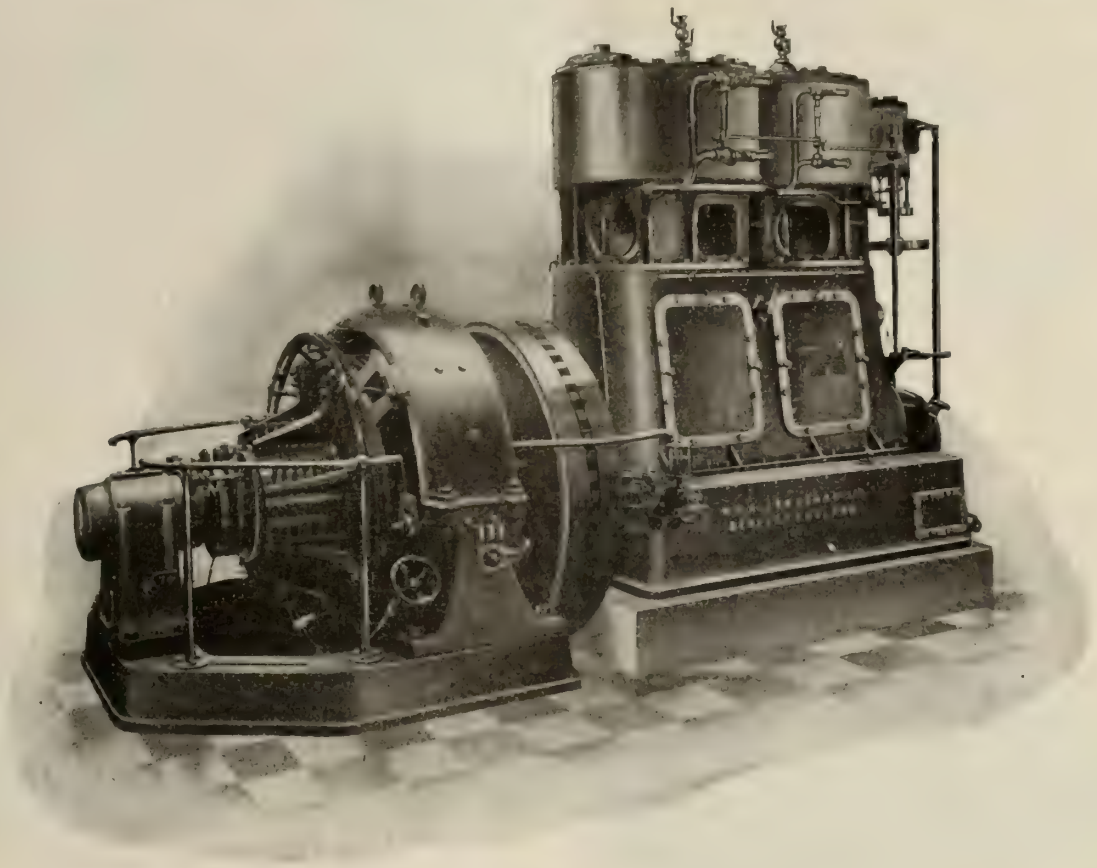
W. H. ALLEN, SON & COMPANY

LIMITED

QUEEN'S ENGINEERING WORKS, BEDFORD, England

ENGINEERS AND BUILDERS OF

Steam, Hydraulic and D.C. Electric Machinery



Installed at the Power House, Toronto University

The illustration represents a standard two crank, compound, enclosed type engine of 440 B.H.P., 400 R.P.M. direct connected to 300 Kilowatt, three wire, interpole, compound generator.

For Prices and Full Particulars apply to the Head Office at Bedford, England

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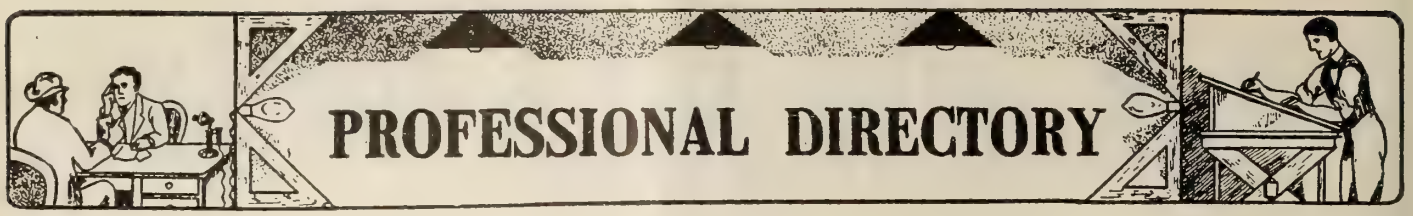

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Power House and Factory Design, Reinforced Concrete.

1011 Electric Railway Chambers Winnipeg

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Mechanical and Hydraulic Engineer

Green Fuel Economizer
Mechanical Draft Apparatus

427 Coristine Bldg., MONTREAL

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Mechanical, Electrical, Hydraulic, Steam, Gas Plans, Specifications, Estimates, Tests, Reports and Supervision

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Desbarats Building. MONTREAL.

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Patents Trade Marks and Designs in all countries

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Consulting and Supervising Engineer.

Pulp and Paper Mills (Kraft), Water Power Plants, Reinforced Concrete Structures, Steel Structures, Estimates, Reports and Surveys. 512 New Birks Building, Montreal.

This space $2.25 per issue on yearly order.

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Examinations, Surveys, Estimates and Designs, Technical and Financial Reports

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Mechanical, steam, electrical and hydraulic engineering. Specialist on Automobile and Gasoline engines. Inspection, Appraisal.

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'Phone Up. 6947.

MICA

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Miners and Exporters of

CANADIAN, AMBER MICA

Kingston Ont., - - Canada

Write us for your requirements in MICA

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AND TRADE MARKS obtained in all Countries.

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Given on Rights and Manufacturing Costs.

WRITE FOR PRICES AND TERMS.

Address: SUITE 301-302, 22 COLLEGE STREET, TORONTO, ONT.

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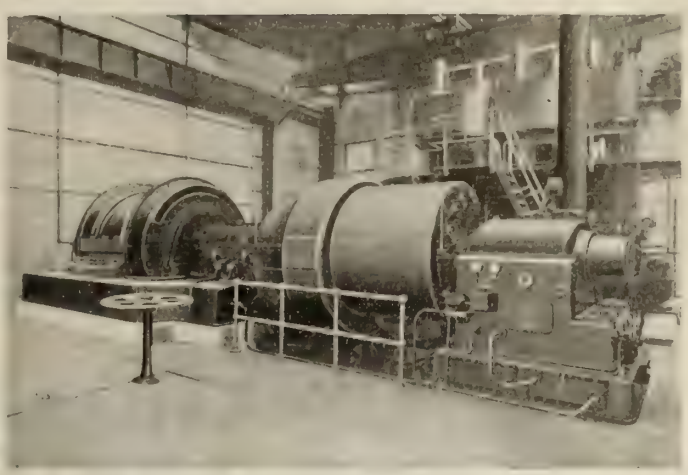
BELLISS & MORCOM

ENGINES——TURBINES
AIR COMPRESSORS

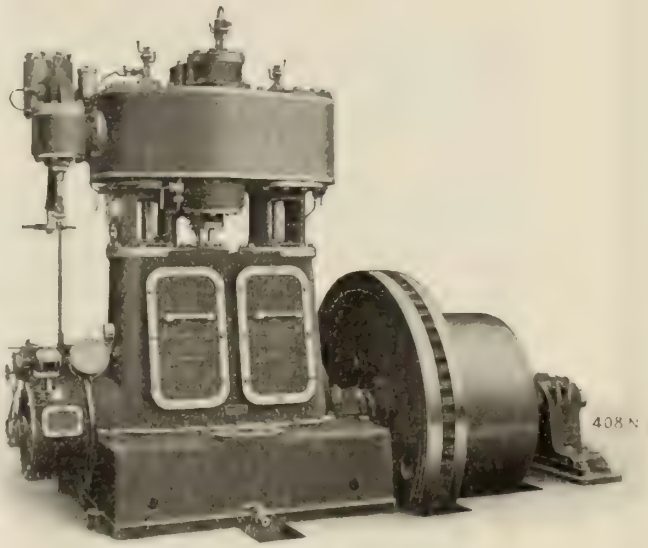


High Pressure Steam Turbine with Alternator.

POINTS IN DESIGN OF TURBINE:

"Impulse" principle.
Drum construction with through shaft.
Each blade held secure independently.
Forced lubrication.
Centrifugal governor with oil relay, etc.
Steam packed bearings.
"Mitchell" disc thrust, also ball bearing auxiliary thrust.
As well as dummy pistons.
With many other points.

The original Quick Revolution Engine, which is being installed in many of the largest plants in Canada. Well known for its economy of steam and oil consumption, as well as for the superior class of material and workmanship embodied in its construction.



Two Cylinder Compound Engine arranged for belt drive

Manufactured by

Messrs Belliss & Morcom

BIRMINGHAM, ENG.

Agents

LAURIE & LAMB

211-212 Board of Trade Building, Montreal

The advertiser would like to know where you saw his advertisement—tell him.

HOTEL FORT GARRY, WINNIPEG

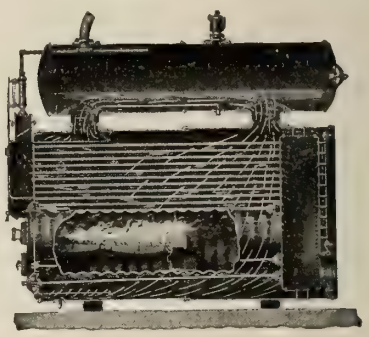
Equipment Service

The building of high-speed compound engines which run economically for years, and boilers which combine low cost steaming with the highest grade of workmanship known to the boilermaker's art is but one function of the engineering organization known as the

INTERNATIONAL ENGINEERING WORKS, LIMITED

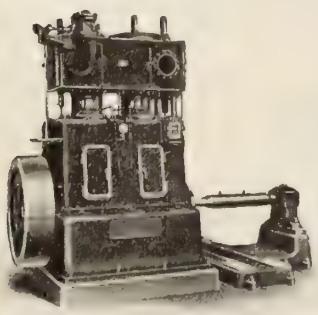
Amherst, N. S.

The new two-million dollar Grand Trunk Pacific Hotel is an example of our achievements in power plant equipment—steam, electrical, refrigerating, water-softening, etc.



ROBB SCOTCH BOILERS, four in number, 300 horse-power each, furnish the steam. A modified form of the Scotch marine boiler having two shells and internally-fired furnaces. An annular plate beneath the front neck insures the positive rapid circulation for quick steaming, great capacity, and clean heating surfaces. This type gives highest economy of fuel as shown by recent tests.

ROBB COMPOUND ENGINES, three in number, drive direct-connected the electric generators. Short-stroke, high-speed, completely enclosed automatically-lubricated—such is the Robb vertical engine. Essentially of the marine type, its many features are well adapted to stationary practice.



These Engines and Boilers are Described in Bulletins Nos. 201 and 3

39-51

Ten Salesmen and Ten Salesmen PLUS—

¶ Let us take two competing firms whose lines are to all intents and purposes exactly the same.

¶ Let their policies and their service be of the same high order.

¶ And let each have *ten* salesmen of average calibre and ability.

¶ All things being equal the result of the competition is a draw. It is a tug of war with an even strain on the rope.

¶ Now let one firm become dissatisfied with this even condition of affairs. Let the idea of advertising possess it.

¶ Let the idea crystalize and publicity be added to the selling force of the progressive house.

¶ Each firm still has ten men on the road. Their individual efforts remain the same, apparently, but ten of them are now reinforced by the mightiest selling force in the modern world.

¶ One firm—the advertiser—slides ahead. The other—the stand-patter—slips behind.

¶ It is inevitable.

¶ Ten men are working under a handicap. Ten men at an advantage.

¶ The tug of war is over. It is now a case of follow the leader.

¶ If you have not already put this tremendous force of advertising behind your men you ought to, and without delay.

Rate Card and full information gladly furnished.

THE POWER HOUSE

A Monthly Publication Devoted to the Generation, Transmission, and Application of Steam, Gas, Electric Air and Water Power.

143 University Avenue, TORONTO

G. & McC. VERTICAL QUICK REVOLUTION STEAM ENGINES

Will give you as they are giving others wherever installed

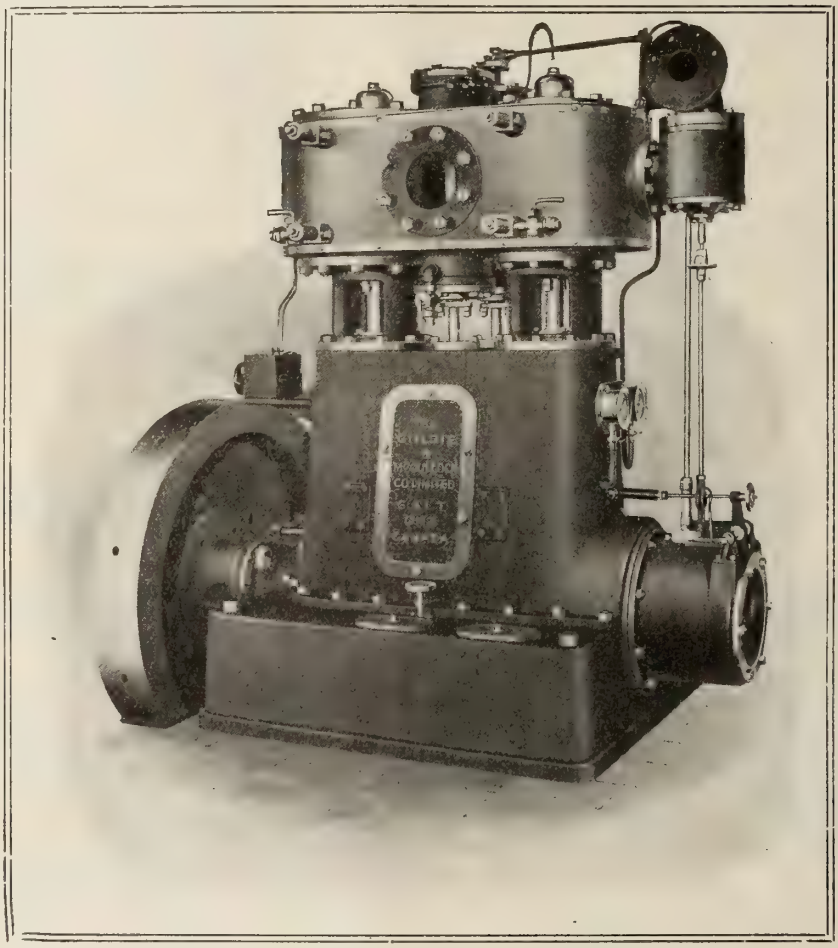
A MAXIMUM OF SERVICE

At a Minimum Cost of Upkeep

These Engines have a Perfect System of forced Lubrication.

They require little or no attention while running.

Built in all types and sizes.



They run with Practically no Noise or Vibration.

All working parts are very easy of Access.

Built to suit your Particular Requirements.

Two Cylinder Compound, Vertical Forced Lubrication, Quick Revolution Steam Engine, with Combined Throttle and Expansion Governor.

All the materials used in the Manufacture of Vertical, Quick Revolution Engines must be the best obtainable. In the construction of our Engines particular attention has been paid to this feature; the materials supplied being in accordance with **British Admiralty Specifications.** All Engines are tested under steam before leaving our works.

We shall be pleased to furnish Specifications and further information.

THE GOLDIE & McCULLOCH CO., LIMITED

Head Office and Works : GALT, ONTARIO, CANADA

Branches or Agencies :

TORONTO	MONTREAL, QUE.	WINNIPEG, MAN.	VANCOUVER, B.C.	ST. JOHN, N.B.
1101-2 Traders Bank Bldg.	Ross & Greig, 412 St. James St.	248 McDermott Ave.	Robt. Hamilton & Co.	13-15 Dock St.

The New Montreal Plant of the Swift-Canadian Co., Ltd.

Staff Article

A description of the latest distributing depot erected by this large firm of packers. It has a capacity for handling half a million pounds of meat weekly and is an excellent example of what an up-to-date cold store should be.

THE Swift Canadian Co., Ltd., have recently opened a modern cold storage plant in Montreal, near Place Viger which, though not large, is of a thoroughly up-to-date type and well equipped for handling a large trade in an expeditious and efficient manner.

The company's head quarters are in Toronto, where all their meat is killed and dressed; and previous to the erection of the plant under notice, their Montreal trade had been carried on under somewhat of a handicap owing to the lack of a modern distributing depot. The new building has already resulted in a very large increase in the local business, over 500,000 lbs. of meat and provisions being now handled every week.

General Features.

The building consists of five storeys and basement, and is of fire-proof construction with framing of reinforced concrete closed in with brick curtain walls. All floors are served by two electrically operated Otis-Fensom freight elevators equipped with safety gates. Artificial lighting is by individual 40-watt tungsten drop lights.

EXTERIOR VIEW OF BUILDING

The basement contains the pickle room, ham soaking tanks, smoke house firing pits, and the compressor room. The latter contains two horizontal Linde ammonia compressors supplied by the Linde-Canadian Refrigeration Co., Ltd. Each compressor has a nominal capacity of 30 tons, and is belt driven at 90 r.p.m. by a Canadian General Electric induction motor of 50 h.p., 60 cycles, 550 volts. Current is purchased from the Canadian Light and Power Co. The two compressors form duplicate sets, either one of them being ample for the present needs of the plant, while the other forms a stand-by unit. As a matter of fact, each compressor when running at 90 r.p.m., is giving a duty of nearly 50 per cent. more than the nominal load.

INTERIOR OF COMPRESSOR ROOM.

The two machines operate on one condenser located on the roof of the building. The condenser is of the atmospheric type, and consists of 2,950 feet of 2-inch pipe, provided with the latest water spray system. City water is used, and is raised to the condenser by an electrically driven 5½ x 8 Deane three-throw ram pump situated in the basement between the two compressors. This pump may be seen in the background of the illustration of the compressor room.

System of Refrigeration.

The direct expansion system of refrigeration is used, there being a total of about 15,000 feet of 2-inch piping throughout the building. The various freezing rooms are cooled by coils arranged along the walls, except in the

VIEW OF BEEF COOLER.

case of the beef cooler and produce room on the first floor. These are cooled by the gravity method. In the case of the beef cooler, the coils are placed in two parallel sets in the lard and cheese cooler on the floor above. From here, the cold air gravitates to the room below through an opening in the floor and displaces a corresponding volume of warmer air which rises by two ducts along the side walls, and thus reaches the coils again to be once more cooled. By this system, a better circulation of air is obtained. The air is consequently drier, and shrinkage of the beef is considerably reduced. Another advantage of the system is that all drips and dirt are kept out of the beef room. The latter, it should be remembered, has a capacity of 600 quarters of beef in addition to a considerable amount of mutton and veal. The room above contains two cold chambers on this floor, one being used for lard and cheese storage while the other is used exclusively for butter cooling.

The third floor is occupied by the sharp freezers, and the fourth and fifth are now being got ready for egg freezers and a sausage making plant respectively. The fifth floor will also be used for storage of cases, etc. The building is equipped with three smoke houses situated on the second, third and fourth floors, the fire pits being in the basement. Hickory wood is the fuel used and each smoke house has a capacity of 100,000 lbs per week.

All the cold chambers throughout the plant are insulated with two layers of cork board, each 3 inches thick. Between the layers, and on both faces is a ½-inch coating of Portland cement plaster to prevent warm air from carrying moisture into the interstices of the cork board. As is well known, cork board depends for its insulating properties on the minute spaces between the particles of which it is composed. When the temperature of these spaces is reduced, the air pressure is also reduced. The result is a partial vacuum into which the exterior air endeavors to penetrate. Warm air nearly always carries a certain percentage of moisture, which thus fills up the spaces in the cork board, greatly decreasing its insulating value; hence the need for an impervious coating, such as the Portland cement plaster here used.

The whole of the freezing rooms have been equipped with the well-known refrigerator doors of the Jones Cold Store Door Co., of Hagerstown, Md. The piping was installed by the makers of the compressors,—the Linde-Canadian Refrigeration Co., Ltd. Mr. A. L. Jewell is manager of the plant and Mr. Neil Gartshore is chief engineer.

SMOKED MEAT SALES ROOM.

LARD AND CHEESE COOLER.

two sets of direct expansion coils totalling 3,500 feet, each set being 50 feet long and seven pipes high by five pipes wide. The two sets are cross-connected in such a way that they can be operated on either of the two compressors,—either singly or in series. Moreover, the exhaust from these coils can be made to pass through the pickle room coils on its way back to the compressor, thus economising ammonia.

Lay Out of the Plant.

As mentioned above, the new Swift building consists of five storeys. On the first floor is located the accounting department, which is comfortably furnished in polished oak with hardwood floors. On this floor, also, are the fresh pork, beef and smoked meat sales rooms, together with the shipping department. The beef cooler and produce room are also on the first floor. On the second floor are the egg candling and butter cutting departments. There are also

LUBRICATING VALUE OF CUP GREASE.

AT a recent meeting of the American Society of Mechanical Engineers, Mr. A. F. Westcott read a paper upon the lubricating value of cup grease. In an able resume of the subject, he said that he had arrived at the following conclusions:—

(1)—Grease lubrication compares favorably with oil where the form of bearing is such as to favor the retention of the film of lubricant, and provision is made for an ample supply to the bearing; but oil will give better results in case of a short bearing in proportion to the diameter.

(2)—Grease of soft consistency is a much better lubricant than the harder densities of the same grease. The advantage of the softer grease is especially marked at low temperatures, such as usually obtained in a well-lubricated bearing.

(3)—The best method of applying grease to a bearing is by forced feed and a constant rate of flow. This agrees with the best practice in oil lubrication where the bearing is flooded with oil, which passes to a filter and is used again. The drawback in case of grease is in cleaning it after it has once passed through the bearing, so that it can be used again. Intermittent application of grease means irregularity in the value of the co-efficient of friction.

(4)—Grease cups with spring-actuated plungers are designed to give a constant flow of grease. They are far from accomplishing this purpose, however. Experiments upon grease consistency show what a great difference in flow is produced by a small change in the pressure upon the grease. A design of cup is desirable which will deliver the grease at a constant rate from the time it is filled until it is empty.

ELECTRICITY AND HYDRAULICS

This department is intended, in addition to individual treatment, to feature the close relationship existing between electricity and hydraulics in the power and light field.

OIL FUEL FOR ELECTRIC POWER STATIONS.

NOW that oil fuel for the Navy is being so much discussed, states a contemporary, it may be worth while drawing attention to a use for fuel oil in stationary electric power stations, although with present prices this use cannot be great. In an electric power station, the load usually greatly exceeds the normal day load once or twice a day, when the lighting comes on in addition to the power load. Corresponding extra boiler plant is needed to supply the steam for these peak loads, and in order to reduce this extra boiler plant to a minimum, the combustion chamber of the boilers is made exceptionally large—always a good feature—and auxiliary oil burners fitted. These are employed at peak load times, and enable the evaporation of the boiler to be considerably increased, thus saving outlay on boilers and buildings. The system has been tried with success in the United States, where oil is relatively cheap.

LOAD FACTOR IN LARGE POWER STATIONS.

WITH the increasing diversity of the load on large power stations, and the better terms offered for limited night and early morning supply, the load factors are steadily improving. The following figures for December, 1912, given by Electrical Engineering, are of interest:—

The Commonwealth Edison Co., of Chicago, had a peak load of 233,000 kilowatts, an annual output of 799 million units, and a load factor of between 43 and 44 per cent.

The New York Edison Co. had a peak load of 210,800 kilowatts, an annual output of 619 million units, and a load factor of 33.4 per cent.

The Brooklyn Edison, Boston Edison, and Philadelphia Electric Companies, with peak loads of from 40,000 kilowatts to 66,000 kilowatts had load factors of 33.7, 30.6, and 32 per cent. respectively.

The Victoria Falls and Transvaal Power Co. expects the load factors of most of its stations to be shortly in the neighborhood of 70 per cent., on account of the almost continuous work at the mines.

TESTING ELECTRIC MOTOR DRIVES.

By John Green.

ELECTRIC motors are beyond all doubt the best, cheapest and most convenient prime movers for woodworking machinery, and the direct-connected induction electric motor leaves little to be desired for driving woodworking machines.

The Overloading Feature

There is, however, another side to the electric motor story—a side which is sometimes neglected to the great delay of the shop, and sometimes such neglect causes costly repairs. The matter to be looked after is the overloading of motor drives. Electric motors are so designed that they will safely handle momentary and frequent overloads of 50 to 60 per cent. of their rated capacity, but that does not mean that a motor will safely carry such an overload all the time.

Overloading a direct-connected motor renders itself visible by sparking between brushes and commutator. When sparking is observed, which will not vanish by carefully adjusting the brushes and cleaning the commutator, then it is time to determine if the motor is working above its rated capacity.

Delivered Power Test.

Testing the power actually delivered by a motor is a very simple matter and very easily performed. All that is necessary is to connect into the circuit a voltmeter and an ammeter and take simultaneous reading from both instruments when the load is on the motor. The load may be roughly determined by using an ammeter alone and depending upon the nominal voltage of the line for the E. M. F. present when the ampere flow is determined.

A still better method of determining the power delivered by an electric motor is to cut into the circuit a recording watt-meter, which continuously records upon a revolving disk of paper the amount of work being performed by the motor under test. By drawing upon the disk circles representing horsepower, the observer can see at a glance the exact power delivered by the motor at each and any minute, while the watt-meter is thus connected up.

With the ammeter alone to determine the power, say 20 amperes were shown to be passing through the motor, simply multiply the number of amperes by the line voltage, and divide by 746. Should the line voltage be 220, then the watts consumed equals $20 \times 220 = 4400$, and $4400 \div 746 = 5.9$ horsepower nearly. Thus, should the test show 20 amperes to be passing through a 5 horsepower-motor, the machine is overloaded, and should be looked after.—Woodcraft.

CANADIAN - AMERICAN POWER CORPORATION.

THE Canadian-American Power Corporation, which has been incorporated under the laws of New York, with offices at Niagara, by interests associated with the re-organization of the Buffalo and Lake Erie Traction Co., will be subsidiary corporation of the re-organized traction company.

The Canadian-American Power Corporation takes over a contract which has been made with the Electrical Development Co., Ltd., of Ontario, and the Toronto Power Co., Ltd., for the delivery of 46,000 horse-power of electrical energy by these companies at the international border. This contract will assure the re-organized traction company an abundance of power for the operation of its lines, and will leave a large surplus, which will be sold for lighting and power purposes in the territory between Buffalo, Rochester, Niagara Falls, and Erie, Pa.

The directors of the power company are: E. G. Connette, Buffalo; S. Reading Berton, Marshall J. Dodge and Francis T. Homer, New York, and Rodman E. Griscom, Philadelphia.

The Economics of Central Station Heating *

By Byron T. Gifford **

There is, we believe, an attractive field open for the establishment of Central Station Heating Systems, and an easily distinguishable tendency to grasp the opportunities offered, is becoming apparent in many directions. The data furnished by the writer of this article is both instructive and conclusive.

THERE are three important branches of central station heating; (a)—the production of heat units; (b)—the distribution of this product; and (c)—making the serivec attractive to the consumer. The first of these, the generation of heat, may be handled by three distinct methods; by direct firing or "straight fuel burning" plants; by an electric generating plant with heating as a by-product; and by a combination of a by-product plant and a heating plant.

By-Product and Heating Plant Combination.

Owing to many causes, the heating plants of the future will be of the last type. In an arangement of this kind, electricity, for instance, can be produced much more cheaply than is possible in the most economical electric plant, and there are a number of ways of disposing of this by-product.

It may be sold to an existing electric plant at a wholesale rate, or a market may be made for it by creating industries requiring a fairly large amount of electricity at a comparatively low price. The author has in mind the case of an industry which has supplied to it 400 kw-hr. of electricity 20 hours per day, 365 days per year, at less than 1 cent per kw-hr. The net income to the heating company from this by-product is more than sufficient to meet the payments of the bond interest, taxes and insurance of the entire property. This additional income, amounting approximately to $11,000, is being handled with an increased operating cost of $2,200, as compared with the operation of the plant the year previous when no electric current was generated. With a simple or a twin Corliss engine, a kilowatt of electricity can be generated under conditions which exist in the average central heating plant with 45 lb. of steam.

Assume, for example, a heating plant serving 200,000 sq. ft. of steam radiation. This load gives an average demand on the boilers of about 40,000 lb. per hour, which, if sent through a simple or twin Corliss engine, will develop 880 kw-hr. of electricity. Assume that this electricity is sold to some consumer for 1 cent per kw.; at this price 1 cent would be realized for every 45 lb., or 22 cents for every 1,000 lb. of steam delivered to the heating mains before it had left the station. The history of central station heating has proved that a rate averaging 60 cents per 1,000 lb. for steam is reasonable, and can be procured from any heating consumer. This would mean 82 cents per 1,000 lb. for the steam generated, which is a good return on the investment.

Development of Heating Plants.

Heating plants in the United States at present vary in size from a connected load of 10,000 sq. ft. of radiation to a connected load of 1,750,000 sq. ft. of radiation. These plants are built in towns of upward of 1,000 people. There are few electric generating plants that can put a kilo-watt-hour of electricity on their switchboard below a cost of ½ cent. per kw-hr., and there are also few electric plants that can generate and distribute to the primary side of their transformers for a cost of 1 cent per kw-hr., especially when the overhead and fixed charges are considered. Heating plants, with electricity as a by-product can do this, and this fact alone will make a place for central heating plants. Some of the larger operating companies are doing this at the present time and others are building properties to operate along this plant.

Distribution.

Regarding the second point, distribution, in water works or in gas properties the losses from distribution consist of leaks and pressure drops due to friction which is caused by insufficient pipe capacities. In central heating, there are these two losses to contend with, and, in addition, the loss from radiation, called "line loss" by central heating engineers. Leaks are a decided detriment to heating pipe line, and the loss from this source is probably more serious than was at first supposed.

Assume for example, a hole ¾ in. diameter in a pipe line containing steam at 5 lb. pressure. With an evaporation of 7 lb. of water per lb. of coal, this leak will cost 23 tons of coal per month. A leak of this size is equally as detrimental in a hot-water heating system. The loss from friction affects, of course, the initial pressure to be carried on the heating mains, and consequently affects the back pressure to be carried on the engines.

As to the detriment of too high a friction loss, in a 3-in. steam line 1,000 ft. long, carrying 1,000 lb. of steam per hour, the friction loss will be equal under average conditions approximately to 1,460 B.t.u. per hour. This same load carried 1,000 ft. in a 3½ in. line will show a friction loss equal approximately to 500 B.t.u. and a 4-in. line under the same conditions will lose only 240 B.t.u. from friction.

The radiation loss from central heating is even more important than friction loss, from the B.t.u. standpoint. There are a number of styles of underground insulation in use to-day, which lose anywhere from 0.03 lb. to 0.38 lb. of steam per sq. ft. of underground surface per hour.

Economical Line Determination.

In order to determine the most economical line to instal, it is necessary to combine the friction and radiation losses. Take, for example, a demand of 1,000 lb. of steam per hour which must be carried 1,000 ft. A 3½ in., 4 in. pipe will do this work, but the most economical size must be determined. The loss from friction would be 1,460 B.t.u. per hour on the 3 in. line; 500 B.t.u. on the 3½ in. line; 250 B.t.u. on the 4 in. line and 130 B.t.u. on the 4½ in. line.

Assume a radiation loss of 0.05 lb. of steam per sq. ft. of under-ground surface per hour; the radiation loss from the 3-in. line will be approximately 45,000 B.t.u. per hour; 3½ in. line approximately 52,000 B.t.u.; 4 in. line approximately 58,000 B.t.u.; 4½ in. line approximately 65,000 B.t.u. Combining these two losses, it is seen that the 3-in. line is the most economical to instal, provided it does not affect the heating station conditions by causing excessive back pressure on the engine.

Experience has shown that a 3-in. line carrying this load the given distance will have a drop in pressure of about 7 lb., and as it is necessary to have 1 lb. pressure at the end of the line, it means that the back pressure at the station would be approximately 8 lb. If this pressure is excessive it would be necessary to run a 3½ in. line, which would give a back pressure of less than 5 lb. The difference in cost between a 3-in. and a 3½ in. line is comparatively small. The cost of material is somewhat less for a 3 in. line; the cost of labor is approximately the same.

Underground Insulation efficiency.

To show the value in dollars and cents of efficiency in underground insulation, a piece of line insulated with a construction that will lose 0.05 lb. of steam

*Abstract of paper read before the Chicago section of the American Society of Mechanical Engineers.

**Manager, Engineering Department, American District Steam Co., Chicago.

per sq. ft. of underground surface per hour may be compared with a line insulated with a construction that will lose 0.14 per lb. per sq. ft. per hour. Both constructions are found in everyday practice. For this purpose an 8-in. line, 1,000 ft. long will be considered. Such a pipe has 2.25 sq. ft. of surface per lineal foot. In the first case, the lineloss will amount to 112 lb. of steam per hour; in the second case to 215 ft. Assuming a generation cost of 30 cents per 1,000 lb., in a season's operation (from October 1 to June 1, or 5,832 hours) a line loss in the first case will equal $195 per year and in the second case $550 per year.

The money saved, therefore, will be the difference between these two figures, or $355 per year. This is 10 per cent. on $3,550, an amount which can be spent to instal the more efficient construction. Since the difference between these line losses is 0.09 lb. of steam per sq. ft. of underground surface per hour, and since the example assumed consisted of 1,000 ft. of 8-in. line, which is 2,250 sq. ft. of surface, it is seen that for every 0.01 lb. of steam saved on this 8-in. line, approximately $400, or 20 cents per sq. ft. of underground surface can be spent.

Comparison of Underground Insulations

Another interesting example is the comparison of two insulations on an entire underground heating installation. This installation consists of approximately 800 ft. of 12-in. pipe line, 1,200 ft. of 10-in. pipe line, 3,600 ft. of 8-in, pipe line, 4,200 ft. of 6-in. pipe line, and 7,300 ft. of 4-in. line and surface. The number of square feet of underground surface in this system is equal approximately to 30,000 sq. ft. Comparing two insulations, one with 0.04 loss and one with 0.09 loss (difference 0.05) by the following formula which the author has derived, the more efficient insulation in this case will be worth $30,000 more than the less efficient:

$$N \times S \times L \times C$$

where

N=the difference between the two insulations in hundreds of a pound of steam lost per hour.

S=the number of square feet of surface per lineal foot of pipe.

L=the length of pipe.

C=a constant based upon the cost of steam per thousand pounds, and the number of hours in the heating season.

Where the steam cost 30 cents per 1,000 lb., and the heating season is 5,900 hours, the value of (C) is 21 cents.

The Consumer Feature.

Regarding the third point, making the service attractive to the consumer, it is not necessary, perhaps, to wrap it up in a good looking package, but it is necessary to have it attractive in price and quality. That this class of service is attractive is shown by the fact that central heating plants, with few exceptions, have had no trouble holding their consumers. It is this one fact, as much as anything else, that has put many heating plants into trouble. They have been tempted to serve a larger territory or more consumers than their plants could economically handle, and they have been tempted also to extend their services without due regard to the economics of the proposition.

As to the best method of selling the heating service, experience has shown that the meter basis is the most equitable. The rate will depend upon local conditions. A number of companies are selling steam on the meter basis, with a sliding scale rate, while others have devised a maximum demand or readiness to serve rate. Both work out admirably in practice. The quality of the service is always sufficiently attractive to obtain a large percentage of the possible consumers.

SMOKE INSPECTION SHAKE-UP IN CHICAGO.

CHIEF OSBORN MONNETT, of the Chicago City Department of Smoke Inspection, took the initiative, says The Industrial World, in a "house-cleaning" in his department recently by summarily discharging nine of his eleven deputy inspectors. The discharged men demanded a hearing on the charges preferred by Chief Monnett.

Mr. Monnett and Assistant Corporation Counsel Leon Hornstein have been supervising an investigation for some time, and have just completed the work on which the action is based. The nine deputies are under eight general charges, including petty graft, loafing, false reporting and insubordination, taking place in the last three years. The following are the charges against the deputies in detail:

1.—Disregarding the duties to which he was assigned, he spent much of his time, while he was believed by his superior officer to be on duty, at other pursuits not connected with his duties or with the department of smoke inspection.

2.—In making his reports he made misrepresentations in regard to the places where he was, the time when he was at work, and the manner in which he employed his time.

3.—He neglected to report violations of the ordinances relating to dense smoke when he knew that such violations existed.

4.—He made out reports at times when he was not actually on duty, but was supposed to be, charging violations of the smoke ordinances when none were observed by him at the time of making such reports.

5.—He used his official position to obtain favors from persons who were prosecuted or were liable to be prosecuted for violations of the ordinances relating to dense smoke.

6.—He visited engineers and others connected with the boiler rooms of buildings and conversed with them in regard to their duties, contrary to the rules of the department of smoke inspection.

7.—He sought to influence parties using coal, engines and boilers, concerning materials and appliances which they required.

8.—He conspired with other deputy smoke inspectors to cast discredit on the smoke inspector, and to bring the department of smoke inspection into disrepute as being inefficient and partisan.

Commission Hearings.

As a result of the hearings, before the Chicago City Civil Service Commission, eight of the nine deputies were discharged.

Evidence was produced tending to prove that certain coal companies in Chicago boasted of their alleged "pull" with the smoke inspection department, and their alleged ability to obtain for their customers immunity for smoke violations. It was shown that while the men were supposed to be traveling their districts, they were for the most part loafing about a sort of clubroom, where they divided the alleged tribute. Eight general charges, involving petty grafting, insubordination, false reporting and loafing were filed against the men by Chief Monnett. Testimony showed that the inspectors worked in relays in obtaining provisions and clothing from firms toward which they showed leniency in making their reports. Reports were shown to have been made almost daily against firms which refused to comply with the deputy inspectors' request for tribute.

Representatives of a number of firms testified to being "held up" by the deputies under threat of prosecution. A statement from W. H. Quirk, chief smoke inspector for the Illinois Central Railroad, was read into the record, in which it is charged that all the accused men were recipients of passes from that Company. Quirk also told in the statement of buying drinks for the men, and that he "could never seem to get them filled up with booze."

Some Lighting Economies in Engineering Works

By Henry S. Whiteley

In many works it is possible to reduce the consumption of electricity for lighting purposes without sacrificing efficiency. The writer here relates a few examples which have come under his notice and may prove of interest to many readers.

IN a modern engineer's erecting shop, having a large bay surrounded by a gallery and served with a travelling crane—the bay, 100 ft. long by 30 ft. wide, was lighted by four 15-amp. open type arc lamps arranged in two groups, two in series per group on 110-volt circuit; the lamps being suspended at a height of 40 ft. so as to clear the crane. The four lamps took 3,300 watts and gave an approximate mean hemispherical candle-power of 5,090, but owing to uneven distribution, they lighted the gallery and crane girders more than the shop floor where it was most needed.

It was decided, therefore, to improve the lighting—and also, what was equally important, to reduce the load on generators, by substituting four of the latest pattern flame arc lamps of the Bremner type, having inclined carbon feed, and using chemical carbons giving a deep yellow light. The new lamps, arranged as before, took 10 amps., or a total of 2,200 watts with an approximate mean hemispherical candle-power of 12,760, and gave an evenly diffused light over the shop floor, besides giving an imaginary sense of warmth due to the color. The saving in watts due to the change was 33½ per cent., or an equivalent of 1.47 h.p., coupled with a gain in candle-power of 250 per cent.

Foundry Example.

In a foundry 60 ft. long by 40 ft. wide, served with a travelling crane, the floor was lighted by means of four open type arc lamps swung on long swivelling arms attached to the rail girders of the crane, so that the latter could pass over, these lamps being also arranged in two groups, one of which took 10 amps. at 110 volts., and the other 6 amps., or a total wattage of 1,760, with a mean hemispherical candle-power of 2,710.

The four lamps were replaced by two flame arcs of the type aforenamed, suspended centrally in the bay, but this time placed at a height just sufficient to clear the top of the crane. The total wattage taken was 1,100, with a mean hemispherical candle-power of 6,380, the alteration thus giving a saving of 37½ per cent. in watts or an equivalent of .88 h.p. Also, there was half the time saved in carboning, besides the use of moulders' hands torch lamps were no longer required when finishing off a mould.

Metal Filament Lamps.

The advent of the metal filament lamp with its 1.0 to 1.5 watts per candle-power compared with the carbon filament lamp taking 3 to 4 watts per candle-power, has proved a boon to householders and shopkeepers in the reduction of their electricity accounts, but for industrial works, particularly where vibration and the use of counterweight fittings are general, the use of the metal filament lamp has usually proved costly, owing to the heavy renewal bill; but, by careful discrimination, it is quite possible to successfully use these lamps and obtain a long life.

To such an end, it is advisable that where there is the least suspicion of vibration, either constant or intermittent, such as that due to the handling of heavy goods on upper floors, they should be spring suspended, and it is a good policy never to use metal filament lamps on counterweight fittings, or where they are liable to receive rough usage; 90 per cent. of failures of these lamps are due to mechanical troubles only.

Individual Lights.

In dealing with the individual lights necessarily required by the operators of various classes of machinery usually 8 or 16 C.P. lamps of the carbon type are used, according to the class of machine. Here, for prementioned reasons, the metal filament lamp is out of the question; but, in a certain case where an economy was desired, the writer obtained very satisfactory results by the adoption of a lamp which possesses the mechanical strength of the carbon lamp, but taking less watts per candle-power—a lamp having a metallic coated filament whose consumption in a 10 C.P. size = 32 watts, and in a 16 C.P. size = 45 watts.

By the use of the 10 C.P. size in 100 lights for machine operators, where formerly seventy-five 16 C.P. and twenty-five 8 C.P. carbon lamps were in use, a saving of 2,050 watts=2.74 h.p. was obtained; but though the total candle-power was considerably less, the intrinsic brightness of the filament was so much higher compared with the old lamps as to make the machinery appear better lighted.

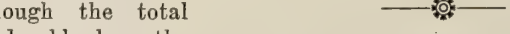
The use of metal filament lamps in groups of three or four placed at an angle is not advised—again owing to breakage of filament. It will be found that one high candle-power lamp is much more satisfactory than four of low candle-power. These high candle-power lamps, as now made from 100 C.P. upwards, lend themselves very well for lighting small areas. A smith's shop with eight hearths was lighted with twelve 16 C.P. carbon lamps, taking a total of 700 watts. At suitable points three 100 C.P. metal filament lamps were placed, and the twelve 16 C.P. lamps removed. The new wattage was 360, or a saving of nearly 50 per cent. = .45 h.p., with a gain of over one-third in candle-power. Also, there was less attention to fittings, and saving of lamp renewals.

A careful consideration of works lighting may often show places where an improvement can be obtained, and particularly do these remarks apply to some of the older installations.—"The Power User."

W. H. ALLEN, SON & CO., TESTING PLANT.

W. H. ALLEN, SON & Co., of Bedford, England, who do a large business in Canada in high speed engines, centrifugal pumps, etc., have remarkably complete arrangements made for testing the product of their works. There are five Babcock and Wilcox land type boilers with superheaters, one having a full load capacity of 20,000 lb. an hour, and four of 6,000 lb. an hour each. The large boiler is fitted with a special type of superheater damper, by which the amount of superheat can be varied. The draught is induced, cold air being driven upwards through the throat of the chimney by a steam turbine-driven fan. All the boilers are hand-fired with Welsh steam coal, experience having proved this method the most satisfactory, when rapid fluctuations in load have to be dealt with.

In the testing department are beds for the temporary fixing of steam engines and dynamos, and steam and exhaust mains are carried along the entire length. For testing centrifugal pumps, a covered-in tank with a capacity of about 28,000 gallons has been provided with four Venturi meters and gauges. The equipment for the testing of centrifugal fans includes a special air trunk and differential draught gauge.



Edward Bennis & Co., Ltd., of Little Hulton, Bolton, England, have received an order through their Canadian Agent, Mr. G. H. Tod, of Toronto and Winnipeg, for three of their new Long-life Chain Grate Stokers from the City of Toronto for the waterworks plant.

REFRIGERATION DEPARTMENT

INTERNATIONAL CONGRESS OF REFRIGERATION.

BY the time this issue of The Power House is in the hands of its readers, the Third International Congress of Refrigeration will have been formally opened at Washington, D.C., by Woodrow Wilson, President of the United States, and the work of the Congress will have begun in earnest at the headquarters, Chicago, Ill., whither the delegates and others will have proceeded on the day following the inaugural ceremonies. September 15 is the day set apart for the Presidential function. The delegates from the various counties participating in the business of the Congress will be taken to Chicago by special trains free of cost.

Held concurrently with the meetings of the Congress, which consists of six sections, will be an Exposition of refrigeration machinery, equipment, tools and supplies relative to the various branches of the industry. In addition, an elaborate programme of entertainment has been provided, including receptions, luncheons, excursions, visits to large industrial establishments, large packing houses, breweries, creameries, ice cream factories, cold storage warehouses, blast furnaces, oil refineries, etc.

General Programme.

The headquarters of the Congress, at Washington, D.C., and office of registration will be at the New Willard Hotel, where all members are requested to register.

At 10.00 a.m. on September 15, the formal opening of the Congress will take place in the auditorium of the new National Museum Building. The delegates will be welcomed by the Secretary of Agriculture and other Government Officials. Addresses will also be made by heads of Official Foreign Government Delegations. Later, delegates will be received by President Wilson at the White House. The afternoon will be spent in sight-seeing trips about Washington, and at 9.00 p.m. a reception will be given in the beautiful Pan-American Union Building. On the morning of the 16th, the delegates and visitors will depart via special trains for Chicago, arriving there on the morning of the 17th. The Congress headquarters at Chicago will be at the Hotel La Salle, where all will register and receive badges, literature, invitations, etc.

The formal opening of the six sections of the Congress will take place at 2.00 p.m., when the several sections will be formally organized, and presentation of papers and discussions thereon begun. At 8.00 p.m. the formal opening ceremonies of the International Exposition of Refrigeration will take place at the International Amphitheatre.

On Tuesday, September 18, meetings of the six sections will be held, opening at 9.30 a.m. This day will be known as "Refrigerating Engineers' Day," and Peter Neff, President of the American Society of Refrigerating Engineers, will preside over the second section. Meetings of the sections will continue half of each day during the Congress, th other half day being devoted to entertainment, sight-seeing of points of interest in or near the city, social functions, etc. On Friday, September 19, an excursion to Milwaukee is arranged, to which all Congress members are invited, without cost.

On Saturday an International meeting of ice men, including producers of and dealers in ice, both natural or artificial, will be held, with a special programme at the Exposition Building, which will be of particular interest to ice men. Prof. Howard T. Barnes, of McGill University, Montreal, Canada, will read a paper on "Ice Formation." An address will also be made by Dr. J. R. Williams, of Rochester, N.Y.

Sunday will be a day of rest and recuperation, but the Exposition will be open all day.

On Monday, September 22, regular meetings of the sections will be resumed, and in the afternoon there will be a meeting of the American Association of Refrigeration, followed by special entertainment. On Tuesday afternoon, there will be a special session of the Food Section, the meeting to be presided over by the President of the American Meat Packers' Association. The closing sessions of the six sections will then be held. On the evening of that day, September 23, the grand banquet will take place, where all the viands served will be such as have been preserved by refrigeration, the foods having been collected, when in their best natural state, by representatives of the United States Department of Agriculture. The history of each article served will be given on the menu cards. The speakers at the banquet will be men of National and International repute. On Wednesday, the 24th, the meeting of the International Association of Refrigeration will be held; and in the afternoon the formal closing ceremonies of the Congress will take place.

The Exposition will remain open until Wednesday, October 1st; and after the close of the Congress, a number of excursions have been arranged for, including a trip to Panama to inspect the inter-oceanic canal and a trip to the Pacific Coast.

International Exposition.

The International Exposition will be held in the International Amphitheatre, Forty-first and Halsted Streets, Chicago, and will remain open from September 17 to October 1 inclusive. There will be shown working and still exhibits of refrigerating machinery, both compression and absorption systems; also exhibits of the variety of appliances and material used for refrigerating and ice making, cold storage, etc. Demonstrations in the manufacture of ice will be given, including demonstration of a "quick freeze" process whereby a 300-pound cake of ice will be frozen in about six hours with brine at 0 degs. F. Demonstrations of the manufacture of liquid air and productions of extremely low temperatures, or temperatures more than 300 degrees below zero Fahrenheit, will also be made. A special committee in New York have been carrying out a series of entertainments and excursions since September 9 for the delegates as they arrive from other countries, preliminary to the official Congress and Exposition functions.

In subsequent issues of The Power House we purpose publishing such details of the Congress proceedings and abstracts of papers read as appeal to those of our readers whose business and calling lies in the wide sphere of Refrigeration and Cold Storage.

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THE STUDY SEASON LOOMING UP.

EVIDENCES are not wanting that the "good old summer time" is becoming spent, and that its once myriad invitations and opportunities for play, at least in our hours of leisure, are dwindling perceptibly in number. The educational side of our nature makes a strong appeal for consideration about this time, and the different technical organizations and institutions which cater to this feature begin to lay their plans to meet the need.

Incidentally, a too large percentage of mechanics are quite deficient in the most elementary principles and application of an education based on reading, writing, arithmetic, grammar and composition, and this we consider a great handicap to the propagation and development of the technical feature. Operative readers should set themselves a course of study in those directions in which they feel themselves most lacking, care being taken, of course, that the achievement set be not so exacting as to become a burden.

SCHOOLS FOR MEN.

IN a recent issue of a contemporary, an article under the above title attracted our attention, and while the necessity has all along existed, although becoming daily more accentuated, it seems somewhat strange that the question of schools or places of education for men has not been given more and earlier prominence. From a considerable experience in teaching subjects relative to mechanical and steam engineering, the lack of and desire for education among men in many sections of industrial activity, were features that it was impossible for us to disregard. Whether we admit it or not, the establishment of technical schools in industrial centres, does not and will not fit the requirement of schools for men, even although, as we are quite well aware that the latter are welcome to avail themselves of all or any of the courses of instruction.

It is not necessarily a man's fault that his education in boyhood, and from thence to manhood, has been neglected; rather, we should say, in the majority of cases, has it been his misfortune. The surfeit of education which has always been a feature of schools generally has contributed largely to the lack of real knowledge and learning, because of the tendency to educational nausea, through an application to more or less immature minds, then incapable of absorbing. We have noted in mixed classes (men and youths), of ages ranging from 40 to 15 years, that the greatest difficulty was experienced in conducting these as a combination unit, there being, in spite of a strong desire to get knowledge, a sensitiveness and diffidence so keen as to be felt, on the part of the elders in the present of those who were 20 to 25 years their junior.

As has been pointed out, correspondence schools and the widespread disposition to take advantage of them furnish ample evidence of the desire and inclination on the part of men to acquire in the way of education, what mature years has made them feel both needful and capable of, and if schools for men were even only to assist in aiding the difficulties besetting the adult student in mastering the requirements of a correspondence school course, then the establishment of schools or classes for men would be worth while.

It takes pluck, yes, we might call it almost recklessness on the part of men to become fellow-students with youths still in their teens, and out of the large number who need and want the instruction, a percentage of those with the dare-devil nature might easily be counted on the fingers of one hand. In the planning of the courses for our technical schools, the feature of classes for men, if schools are unobtainable, would supply a much felt want, and yield results which would not only compare, but might surpass those of budding youth.

WHEN you think you are too old to learn, it simply means that you are getting too stubborn and contrary, for there is no age limit to learning new things.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in the Power Field.

Thomas A. Edison, the inventor, is ill at his home in Llewellyn Park, N.J.

Wm. C. Willard has been appointed Assistant Professor of Railway Engineering at McGill University, succeeding Professor Smart, resigned.

Hilder Daw, C.E., has been retained by the city of Sherbrooke, Que., to revise the present plans and design of drainage and purification system for that city.

Wm. Brownhill Smith, a member of the Electrical Committee of Glasgow, Scotland, where a municipal electrical plant is about to be constructed, costing over a million dollars, is traveling in Canada making a preparatory inspection of provincial and municipal electric power systems.

R. G. Black, consulting engineer, has been appointed a member of the Toronto Hydro-Electric Commission to fill the vacancy caused by the resignation of H. L. Drayton, K.C., some months ago. Mr. Black's appointment was made by the Provincial Hydro-Electric Commission. Mr. Black has had considerable experience in electrical management. He is a graduate of the University of Toronto, and was for some years chief engineer of the Toronto Electric Light Co. Subsequent to his resignation of this position, he spent some two years of study in the Old World, and has practised of late as a consulting engineer.

Belleville, No. 34, C.A.S.E.—Officers of Belleville, No. 34, C.A.S.E., for the ensuing year are as follows: William Cooke, president; E. Beal, vice-president; F. Burke, Conductor; H. Williams, doorkeeper; William Gorham, treasurer; F. H. Chesher, secretary. Last month six members were initiated, on which occasion Bro. Chas. Moseley was present. Commencing October 1, two nights each month during the winter will be devoted to educational work and study relative to steam and electrical engineering practice. Bro. F. H. Chesher will have charge of the instruction, and in view of the fact that a large proportion of the recently added membership consists of young men, arithmetic will be made a foundation feature.

STRATFORD'S G.T.R. BOYS MADE CLEAN SWEEP.

THE city of Stratford made a clean sweep in the prizes for mechanical drawings at the C. N. Exhibition. The winners are all apprentices in the Grand Trunk shops at Stratford. There were twenty-five drawings in the competition, many of which were from Montreal. The following are the results:—

Drawings of steam driven machinery, 1st prize, $20—J. F. Tonye.

Drawings of electrical equipment, 1st prize, $10—L. Bexon.

Drawings of hydraulic or pneumatic machinery, 1st prize, $10—L. Ireland.

The city's showing reflects great credit on Master Mechanic Robt. Patterson.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS

Past President—J. A. Robertson, Stratford, Ont.
President—S. Cosford, London, Ont.
Vice-President—A. W. Heath, Hamilton.
Secretary—A. Kastella, Ottawa, Ont.
Treasurer—W. E. Archer, Hamilton.
Doorkeeper..E. Hooey, Owen Sound, Ont.
Conductor—Robert Dyson, Guelph, Ont.

DEMAND FOR ELECTRICAL APPLIANCES.

THE increased activity in electrical engineering throughout the world has naturally caused an enormous advance in the demand not only for machinery, but also for materials such as lamps, batteries, and other sundries, but it is rarely realised how much the expanding trade in these goods has been to the benefit of firms handling British lines.

For instance, the annual purchases of British electrical goods, exclusive of machinery, by Australia have risen within five years from £350,000 to £858,000; in the case of India, from £223,000 to £330,000; South Africa, from £99,000 to £307,000; New Zealand, £78,000 to £153,000; and Canada, £49,000 to £278,000; while the demand on behalf of countries outside the Empire is hardly less remarkable, as exemplified by Japan, which last year purchased British electrical goods, exclusive of machinery, to £375,000, against £126,000 in 1908; Egypt, £395,000, compared with £23,000 in the former period; the Argentine, £268,000, contrasted with £148,000; and Brazil, £167,000, against £86,000. Even the United States, strange as it may seem, last year bought British goods of this class to no less than £169,000, against only £9,000 five years ago.

The item referring to Laurie & Lamb in our August issue, under the heading "Trade Gossip," and particularly that part relating to their having received an order for one 75 h.p. Bellis & Morcom engine from the town of Kamloops, Alta., should read, Camrose, Alta., instead of Kamloops.

LODGE SECRETARIES, CANADIAN ASSOCIATION OF STATIONARY ENGINEERS

F. Chesher, 152 Charles St., Belleville, Ont.
A. W. Heath, 111 Burris St., Hamilton, Ont.
D. F. Campbell, 114 Simcoe St., London, Ont.
J. W. Marr, 78 Duke St., Toronto, Ont.
F. Revell, P.O. Box 84, St. Thomas, Ont.
S. Smith, 506 VanNorman St., Port Arthur, Ont.
W. Needham, 2089 3rd Ave. East, Owen Sound, Ont.
J. Thompson, P.O. Box 109, Stellarton, N.S.
W. Congdon, 23 Dower St., Chatham, Ont.
R. Dyson, 211 York Road, Guelph, Ont.
J. A. Robertson, 68 Nile St., Stratford, Ont.
C. J. Lake, 13 Larch St., Ottawa, Ont.
J. Ogle, 73 Richmond St., Brantford, Ont.
E. W. Berry, 123 Main St., St. John, N.B
F. J. Aldred, P.O. Box 191, New Aberdeen, Glace Bay.
C. Emmerich, 186 Victoria St., Berlin, Ont.
G. E. Pearce, Fire Department, Wallaceburg, Ont.
C. Caswell, Lowell Street, Galt, Ont.
W. A. Milne, 393 Princess Street, Kingston, Ont.
Chas. Maidel, 64 Pitt Street E., Windsor, Ont.
J. J. McCaffrey, P.O. Box 35, Trout Mills, North Bay, Ont.
T. J. Mackie, Brampton, Ont.
W. J. Davis, Box 495, Arnprior, Ont.

THE OPERATORS' VIEWPOINT

Devoted to brief descriptive article contributions covering ideas and experiences pertaining to power plant practice and operation. We pay for accepted material.

BOILER EXPLOSIONS FROM SHORTNESS OF WATER.

By William Buchan.

BOILER explosions from shortness of water would be materially reduced if attendants, instead of opening only the drain taps of water gauges, tested them daily in the following manner to ensure that both the steam and water passages were perfectly clear: (1)—Shut top tap. (2)—Open drain tap; a full flow of water shows that the water passage is quite clear. (3)—Shut bottom tap. (4)—Open top tap; a full flow of steam shows that the steam passage is also clear. (5)—Shut the drain tap. (6)—Open the bottom tap; the water should not be sluggish in returning to the glass.

These operations involve a certain amount of trouble, but they ensure that the glass will indicate correctly, and also that the taps can be closed should a glass break. Gauges on water-tube boilers are often fitted with special rods and handles, by means of which the taps can be operated either from the floor or platform at the gauge level. A tail pipe fitted to the drain tap, and provided with a valve near the ground level, is an exceedingly useful adjunct for frequent use, but it does not dispense with the regular routine testing referred to above. Where there are a number of high pressure boilers, the risk of scalding can be greatly reduced if the attendant who tests the glasses wears a mask and gauntlets.

POWER PLANT WRINKLES.

By John Thorn.

IN many small plants the engineer will do odd jobs of brick work around the engine or boiler room, and especially so if he has a fireman who is trustworthy and capable of looking after the machines occasionally when the engineer is busy elsewhere.

Now I imagine it is a mistake for any engineer to do this kind of work unless he understands how to do cement mixing properly, for I believe nothing but cement mortar should be used in foundation work of any kind, brick, stone or grout. Some engineers will build a foundation from the floor up for any and every piece of apparatus, no matter how small, but this is a mistake, as it takes considerable work to keep the apparatus clean, in many cases the foundation making it difficult to get at the bottom of the machine properly, therefore dust or other dirt and oil get a chance to collect.

In the plant where I am at present employed we have several duplex and Northey boiler feed pumps supported by brackets made of iron, as shown in Fig. 1. A glance will show the reader that it is a snap to keep things clean around them. I believe the brackets have been there for about 20 years, for to my own knowledge they have been there 11 years, and so far as I can see they are as good and firm to-day as the day I first saw them.

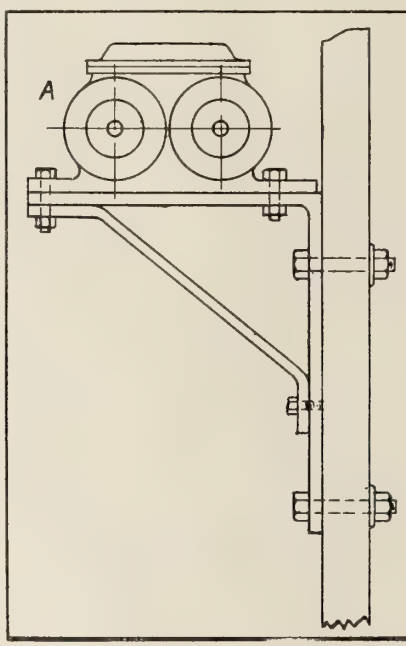


FIG. 1. BRACKET SUPPORT FOR PUMP.

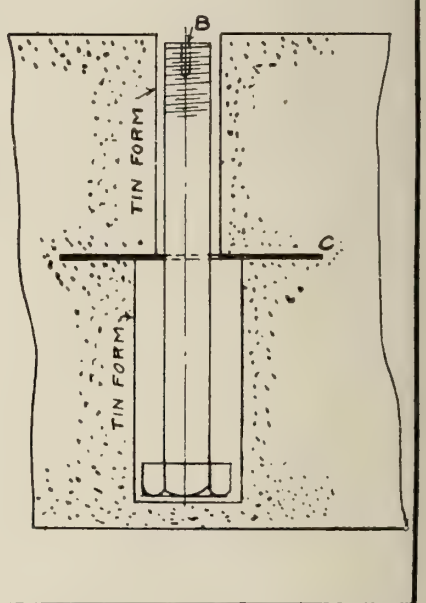


FIG. 2. FOUNDATION BOLT KINK.

Another good wrinkle I saw used at the C. G. E. Co. works at Peterboro is shown in Fig. 2. When building a foundation for a heavy machine, the bolts are generally cemented in with the thread end projecting above the foundation the length necessary to pass through the machine base. Should the machine weigh some tons, great care has to be exercised so that while placing it in position none of the bolt threads are injured, and to overcome this danger make two tin forms, or two pieces of iron pipe of the right diameter will do. The bottom one should be big enough to allow the bolt head to pass through and be as long as the depth of the machine base, while the top one should be as long as you wish the concrete to be between the machine and the foundation bolt head. Between the two should be inserted an iron plate with a hole drilled in the centre to allow the bolt to pass through, as shown at (C). At (B) a small hole is drilled and threaded in the centre of the foundation bolt. When the machine is in place, a small threaded rod can be screwed into the hole (B), and the bolt pulled up until the head comes against the iron plate (C). This makes an ideal device to use for a machine which has to be removed at times.

ELECTRICAL GENERATOR TROUBLE.

By Clifford Banner.

AFTER reading the article entitled á "Motor Breakdown" in your August issue, it occurred to me that the following personal experience with a 6,600 volt, 3-phase, 60 cycle, 150 k.w. revolving field generator might be of interest to many readers of The Power House:

Some time after the machine had been installed, lightning was observed on several occasions to be passing through it to the ground. The flashes could be plainly seen, and trouble was naturally expected any moment. The arresters, of which there was one on each leg of the circuit, did not seem to operate. A few months elapsed, however, before trouble developed, and this took the form of a coil burning out. The coil was cut out and bridged. Another, and yet another coil failed in subsequent operation. These were renewed, and the trouble finally overcome by cutting out gaps in the arresters. The latter have 16 gaps and 4 sections of resistance in each leg. The gaps were cut out by inserting strips of sheet metal between them, until only 4 gaps remained in each arrester. It was also found that one of the leads to the automatic switch solenoid was fused off, but the switch was known to have been in operating order after the lightning found its way into the machine the first few times. I don't know what could have caused the breakdown. The punctured insulation would cause a slight leak, and this would grow more pronounced until it broke down altogether.

Mr. Adams in his "Motor Breakdown" article does not state whether or not there were arresters fitted. Again, I do not think that any automatic switch is protection against lightning. In the case of the generator referred to in this article the management forbade its operation during an electrical storm when the trouble first showed up, but now we take no notice of storms.

BABBITT METALS FOR BEARINGS.

IN the course of a paper on bearing metals, read before the American Society for Testing Materials, Mr. T. D. Lynch, as the result of a series of tests on Babbitt metals, arrived at the following conclusions:—

(1)—The number of compositions of Babbitt metals should be as few as possible, preferably one of the tin-base and one of the lead-base, and each should be made the best of its class.

(2)—The constituent metals must be of superior grade, carefully tested and inspected, since the first requisite is a good raw material.

(3)—The alloying or smelting is of vital importance, and must be so done that the high and low melting point metals may be properly alloyed far below the melting point of some of the component parts. A temperature of 500 deg. C. and less has been found to be sufficient to obtain satisfactory alloying of Babbitt metal. The melted metal should at all times be kept covered with powdered charcoal or other protection from oxidation.

(4)—Pouring the Babbitt too cold tends to produce a granular or coarse crystal formation, and pouring it too hot tends to produce a softening effect. The lead-base Babbitt is not nearly as fool-proof as the tin-base, and, therefore, the range of pouring temperature is more limited. However, a pouring temperature of 460 deg. C. (450 deg. to 470 deg. C.) for both lead-base and tin-base Babbitts has been found to give excellent results.

(5)—Heating the shell to 100 deg. to 150 deg. C. before the Babbitt is poured into it tends to prevent blow-holes and similar defects, and also prevents the lining from shrinking away from the shell.

(6)—Babbitted bearings must not be jarred while the metal is solidifying, since any disturbance at this temperature tends to enlargement of the crystals and corresponding brittleness.

(7)—The matrix of the lining metal should be just stiff enough to support the hard crystals. These hard crystals should be as numerous as possible, and yet not lie on each other to cause brittleness.

(8) A Brinell hardness of 23.5 for lead-base and 30 for tin-base Babbitts has been found to give excellent results.

BASEBALL IN THE POWER PLANT.

By Bill.

THE game started with Plug Valve at the stick. Drip Pan was catching. Packing was in the box holding tight, but letting loose sometimes. Whistle was playing first base. Armature was in the field. Refrigerator and Ice kept cool. Gauge was at centre and showed up well. Tongs and Wrench sent in some twisters, while Safety Valve played at such high pressure that he blew off. Steam had a good head, so remained in his place. Oil was slippery, and moved all over easily. Fire Door said that the whole bunch should be shut out. Boiler could not stand the pressure, so went up in the air, but covered a lot of ground when he cooled down. Engine ran wild, but Governor, who was umpire, soon brought him to time. Waste was canned, and Hammer was knocking, so they locked Waste up and sent Hammer to the bench. Belt made some good runs, but required watching, as he was loose in the joints, and made some bad slips. Smoke also went up in the air, but poor Ashes fell down. Water was the best runner, but Babbitt would not run at all until Shaft made him hot by continually running against him.

DANGERS PECULIAR TO BOILER MOUNTINGS.

By William Buchan.

MANY serious boiler explosions have been due to the use of defective mountings. No greater mistake can be made than to attempt to reduce the initial cost of a boiler by purchasing cheap mountings which may be a constant source of trouble owing to the inferior quality of the material or the lack of some detail essential for safety. Too much attention cannot be given to the upkeep of mountings, and some firms follow the excellent practice of keeping a spare set so that any defective fittings may be replaced. This reduces the inconvenience due to stoppage and, at the same time, removes the temptation to continue their use until they become positively dangerous. Provision for the reception of the various mountings on the boiler should be made in the form of branches and steel blocks, which should be carefully bedded and riveted to the boiler plate, and all surfaces for mountings should be machined. In fitting the mountings, care should be taken to make the joints steam tight, and to ensure this, the bolt holes should be pitched close enough to prevent leakage if the plates are sprung under steam pressure.

BENDING CAST IRON PIPES.

AN interesting account is given in the Engineering Record of a method of bending cast iron pipes carried out on a pipe-line from the Guayabo River to the town of Preston, in Cuba. The place where the curved pipes were required was a remote one, and as, through some oversight, straight pipes had been delivered instead of curved ones, it was decided to bend these, if possible, rather than delay the work until other pipes could be cast and delivered. The curves to which the pipes had to be bent varied, the shortest being 50 ft.

A cradle of old rails was first constructed, having the desired amount of curvature, and on this the pipes were laid, about one foot at each end projecting beyond the cradle. A fire of hard wood was then built up round the pipes, six or eight pipes being treated at one time. In 1½ hour to 2 hours after starting the fires, the pipes were hot enough to bend, and they settled down from their own weight on to the cradle prepared for them. The particular pipes treated were 10 in. diameter, the thickness of the shell being 9-16 in.

Practical Questions and Answers for Engineers

The present series of Questions and Answers will be departmental in their scope, its being our intention during the course of publication to have an equal number appear in each issue relative to two sections of power plant operation and practice. Comment and inquiry is invited.

THE STEAM BOILER.

Question.—Why are the tubes beaded on the rear head of a return tubular boiler, and need they be so on the front head as commonly practiced?

Answer.—The tubes are beaded on the rear head because the thin edge projecting beyond the plate is removed a considerable distance from the water and meets the gases from the fire grate before they have transmitted their high temperature heat sufficiently to ensure against the tube ends becoming red hot, burning and loosening the effectiveness of the tube expanding. They need not be beaded on the front head, because by the time the gases reach there, their temperature is or should be reduced on economical grounds to a point below that of danger of burning. Further, the gases are passing out instead of coming in and impinge less hurtfully on the tube edges.

* * *

Question.—In calculating the strength of riveted joints on a boiler shell, the solid plate is reckoned as being 100 per cent. What are the comparative percentages that can be got by using single, double and treble riveted lap joints, double and treble riveted butt strap joints?

Answer.—Single riveted lap, 56 per cent.; double riveted lap, 70 per cent.; treble riveted lap, 75 per cent.; double riveted double butt strap, 80 per cent.; treble riveted double butt strap, 85 per cent.

* * *

Question.—What constitutes the total heating surface of a return tubular boiler set in brickwork, and what would it amount to in a boiler 72 inches diameter, 18 ft. long, tubed with seventy-six 3½-inch diameter tubes?

Answer.—The lower half of the shell throughout its length and the surface of all the tubes constitute what is known as the total heating surface in this type boiler. The shell heating surface amounts to one-half the shell circumference in feet multiplied by its total length, also in feet. Thus 72 inches, which is 6 feet, will have for half circumference

$$\frac{6 \times 3.1416}{2} = 9.4248 \text{ feet, then}$$

9.4248 × 18 feet length of shell will give 169.64 square feet or quantity of shell heating surface required. The tube heating surface is the circumference of the external diameter of one tube in feet multiplied by the length of tube, also in feet, and again multiplied by the total number of tubes. The circumference of one 4-inch tube in feet is found thus

$$\frac{3.5 \times 3.1416}{12} = .9163$$

We divide by 12 because the multiplication of the two upper quantities gives result in inches. Then .9163 × 18 × 76 = 1253.5 square feet tube surface.

1253.5 + 169.64 = 1423.14 square feet total heating surface of boiler.

* * *

Question.—What is the rated horsepower as near as you can estimate it of a 72-inch diameter return tubular boiler, 18 feet long, having 76 3½ inch pipes?

Answer.—A common method of rating the horse-power of a return tubular boiler set in brickwork is to assume from 10 to 12 sq. ft. of heating surface as the equivalent of one horse power. From the previous question, and answer thereto, covering a boiler of dimensions similar and equal to that for which the rated horse-power is required, we find that the total heating surface is 1423.14 sq. ft. This quantity divided by 10 or 12, gives the horse power called for, thus:—

$$\frac{1423.14}{10} = 142.3 \text{ h.p.} \qquad \frac{1423.14}{12} = 118.59 \text{ h.p.}$$

Both divisions are in general use, and constitute, in either case, the commercial standard classification adopted by any particular boiler manufacturer. It may be stated here, however, that in reality there is no such thing as boiler horse-power, the real measure of a boiler being its ability to generate a given quantity of steam in a given time.

* * *

PIPES AND FITTINGS.

Question.—What is understood by the term "water hammer"; how is it caused, and what have been the experiences of its effects?

Answer.—Admission of steam under pressure into a pipe containing water is liable to set the latter in rapid motion. This may also happen, while draining a pipe under steam pressure, by the condensation of the steam caused by its sudden contact with a large surface of comparatively cold water. In either case, the water will usually strike the side of the pipe or any obstruction, such as a valve, sharp bend or dead end of a pipe, with considerable violence, accompanied by a hammer-like report. Water-hammer has caused the fracture of many stop valves and steam pipes and even a few blow-off valves and pipes. Water-hammer can only be avoided by preventing the accumulation of water in the steam pipes.

* * *

Question.—What precautions should be taken to prevent accidents from bursting water gauge glasses?

Answer.—To prevent accidents from bursting gauge glasses they should be of good quality, and the fittings should be in line. When putting in a glass it should be placed in the recess of the bottom fitting and the gland screwed up; then, after it is secured in the top fitting in a similar way, it should be possible to turn the glass by hand. The renewal of gauge glasses every six months instead of waiting until they break is very good practice.

* * *

Question.—What is the function of a fusible plug as fitted to steam boilers; of what does it consist, and how does it accomplish its purpose?

Answer.—Fusible plugs provide a valuable safeguard against serious explosions and collapse of furnace crowns due to low water. They should be fitted directly over the fire in all straight furnaces and in the crowns of all fire-boxes. A fusible plug consists of a metal cone, as small as practicable, held in position in a conical cap by an alloy ring of low melting point. Should the crown of the furnace become overheated through want of water, the alloy melts before there is any serious danger, the cone drops, and the escaping steam puts out the fire. Fusible plugs are not reliable unless they are kept perfectly clean on both sides. They should be examined at each cleaning time, and the fusible metal renewed periodically. One leading railway company makes a practice of renewing, monthly, the fusible metal of the plugs in the fire-box crowns of their locomotive boilers, while insurance companies dealing with stationary boilers recommend renewal at intervals, varying from one to two years, depending on the nature of the feed water and other local circumstances. Most types of plugs are now fitted with a cap that can be easily renewed, and a number of spare caps should be kept to prevent delay in the event of a plug melting. It should be remembered that if a boiler fire is lighted when the boiler is short of water, the metal in the fusible plug may melt, but the fire will not be put out owing to the absence of steam under pressure.

C.A.S.E. 24th Annual Convention Business Proceedings

The business side of the Canadian Association of Stationary Engineers' recent gathering at Owen Sound is fully dealt with in the accompanying article. Unanimity of opinion is a notably characteristic feature of the proceedings, which savour of rather more aggressiveness on the part of the Association than formerly.

THE 24th annual convention of the Canadian Association of Stationary Engineers, opened at Owen Sound, Ont., on Monday night, July 28th, the following executive officers being present:—Bro. J. Robertson, president; S. Cosford, vice-president; W. E. Archer, treasurer; A. Kastella, secretary. After discussing things material and approving different recommendations, the meeting adjourned until Tuesday, July 29th at 2 p.m.

Tuesday, July 29.

The grand opening took place in McLinden's Hall at which the engineer delegates, ladies, supply men and visitors were present in large numbers. His Worship Mayor Lemon addressed the meeting and extended to the visitors a hearty welcome. Addresses were also delivered by Messrs. Robertson and J. E. Fiddes. After the opening ceremony, the delegates held a session, at which committees were appointed.

Brother Heath of Hamilton, was appointed conductor, pro tem, and Bro. Cook of Belleville, door keeper, pro tem, as Bros. Chester and Bishop were unable to attend.

The report of Committee on Credentials having been read, Bro. Crockett moved seconded by Bro. Nagle, and carried, that this report be adopted. The president's address having been read, it was moved by Bro. Moseley, seconded by Bro. Crockett, and carried that same be received and handed to the Good-of-the-Order Committe, carried. The minutes of the last convention were then read, after which Bro. Revell moved, seconded by Bro. Moseley and carried, that the minutes be adopted.

Secretary's Report.

The secretary's report from January 1, 1913, was as follows:—

Cash received	$517.29
Cash paid	287.60
On hand	$117.25

Moved by Bro. Brown, seconded by Bro. Cosford and carried, that secretary's report be received and handed to the Auditing Committee.

Treasurer's Report July 1, 1912, July, 1913.

Receipts.

Cash on hand July 1, 1912	$261.36
On account per capital tax	211.00
On account organization fund..	16.00
On account stationery and supplies	41.00
Received from Bro. W. C. Crockett	397.82
Interest on bank deposits	7.95
	$935.13

Disbursements.

1912 convention expenses	$224.65
Honorarium to secretary, treasurer, caretaker	40.00
Past presidents' jewels and emblem	61.30
Printing	142.50
Executive meetings	52,25
Postage and sundry expenses.	18.85
Balance on hand and in bank..	395.58
	$935.13

Moved by Bro. Wickens, seconded by Bro. Revell and carried, that treasurer's

1913 C.A.S.E. CONVENTION GROUP PICTURE, OWEN SOUND, ONT.

report be received and handed to the Auditing Committee.

A long discussion followed in regard to organizing subordinate lodges in other provinces, also the consideration of starting a sick benefit fund. Moved by Bro. Archer, seconded by Bro. Tait, and carried, that the question be handed over to the Good-of-the-Order Committee.

July 30th, 10.00 a.m.

Election of Officers.—Moved by Bro. Crockett, seconded by Bro. Hooey, that the election of officers be laid over, but after a short discusion, this motion was withdrawn and the election followed.

Past President, Bro. J. A. Robertson.

President, Bro. Cosford (acclamation).

Vice-President, Bro. Heath (acclamation).

The following were nominated for the office of conductor:—Bros. Cooke, Dyson, Brown. Bro. Dyson of Guelph, was elected.

The following were nominated for the office of door-keeper: — Bros. Hooey, Revell, Brown, Cooke. Bro. Hooey of Owen Sound was elected.

Secretary, Bro. Kastella (accl.).

Treasurer, Bro. Archer (accl.).

Auditors' Report.

Secretary—Cash received		$517.29
Cash paid		287.60
Balance		$229.69
Treasurer—Receipts		$935.13
Expenditures		539.55
Balance on hand		$395.58

We found a difference of $5.00 between the treasurer's book of last year and statement of last year's expenses of Belleville Convention as printed in the minutes. This was straightened out satisfactorily.

In auditing supplementary of Bro. W. A. Crockett, we found a balance of $40.00 due to this association. This was explained and straightened out satisfactorily. — John Brown, Robt. Dyson, Geo. Fowler.

Moved by Bro. Wickens, seconded by Bro. Crockett and carried, that the auditors' report be received and adopted.

July 31, 1913.

Meeting opened at 9.45 a.m. with expresident in the chair. The Ways and Means Committee and the Good-of-the-Order Committee worked in conjunction and brought the following recommendations:—

Clause 1.—Regarding uniform construction law; this is now in force.

Clause 2.—Re sick benefits. We recommend the Executive to devise a plan or form for this, and forward to each lodge ,so that a plebiscite vote be taken and reported before next convention.

Clauses 3 and 4.—Recommend that we notify the Ontario Government that because at the last session of the Ontario Legislature, the matter of graded certificates was deferred, we will issue certificates to our own members stating their abilities and qualifications.

Clause 5.—We recommend that the secretary communicate with the mechanical papers to see what arrangements can be made whereby a certain portion of the paper will be devoted to the interests of the C.A.S.E. and to report to all lodges for their consideration and report back to the Executive.

Clause 6.—Re Ladies' Auxiliary. We recommend that the secretary have some charters for the Ladies' Auxiliary printed, and that the subordinate lodges be requested to bear the operating expenses for this year.

Clause 7.—We also recommend that the word "every" on page 17 of the printed minutes of the Belleville convention be struck out. Re the establishing of lodges in other provinces, we recommend that application received be acted upon, and charter granted to them with the provision that when three or more lodges are in operation, they have their own Executive and hold conventions in their own provinces, the whole being in conformity with our Executive Constitution.—Signed, A. M. Wickens, J. A. Robertson.

Moved by Bro. Archer, seconded by Bro. Wickens and carried, that Clause 1 be adopted as read.

Moved by Bro. Dyson, seconded by Bro. Nagle and carried, that Clause 2 be adopted as read.

Moved by Bro. Archer, seconded by Bro. Tait and carried that Clause 3 and 4 be adopted as read.

Moved by Bro. Wickens, seconded by Bro. Cook and carried, that Clause 5 be adopted as read.

Moved by Bro. Wickens, seconded by Bro. Crockett and carried, that Clause 6 be adopted as read.

Moved by Bro. Moseley, seconded by Bro. Swanson and carried, that Clause 7 be adopted as read.

Moved by Bro. Norris, seconded by Bro. Wickens and carried, that all lodges, with knowledge that the present engineers' law is not being adhered to be good enough to notify the Executive secretary at once, and give him a true statement, so that he can make complaint to the proper authorities.

1914 Convention.

The next order of business was the 1914 place of meeting. Telegrams were read from Mayor, President Board of Trade and Local Lodge No. 7, also from the Mayor of St. Thomas. Bro. Nagle, of Port Arthur, Ont., invited the association to meet there. It was unanimously decided to hold the next convention at Ottawa.

Moved by Bro. Crockett, seconded by Bro. Nagle that a telegram be sent to Mayor of the City of Ottawa thanking him for the kind invitation, also stating that the next convention would be held there.

Moved by Bro. Dyson, seconded by Bro. Swanson and carried, that the account of $218.00 convention expenses be paid.

Moved by Bro. Moseley, seconded by Bro. Dyson and carried, that the president's account of $9.91 be paid.

Moved by Bro. Brown, seconded by Bro. Revell and carried, that the account of $30.00 from Bro. Crockett be paid.

Moved by Bro. Brown, seconded by Bro. Hooey and carried, that the expresident see that every delegate attending convention receive a copy of his recommendations.

Moved by Bro. Crockett, seconded by Bro. Nagle and carried, that $30 honorarium be granted to the Executive secretary.

Moved by Bro. Crockett, seconded by Bro. Brown and carried that $10.00 honorarium be granted to the Executive treasurer.

Moved by Bro. Crockett, seconded by Bro. Nagle and carried, that the usual jewels be given the retiring president.

Moved by Bro. Moseley, seconded by Bro. Brown and carried, that the treasurer receive the president's jewel.

Installation of Officers.

The installation of officers then followed, and all newly elected officers were duly installed by Bro. Crockett.

Moved by Bro. Kastella, seconded by Bro. Robertson and carried, that a vote of thanks be tendered to Bro. Crockett for the able manner in which he installed the new officers.

Bro. A. M. Wickens in a neat speech presented the president's jewel to the retiring president, Bro. Robertson.

Moved by Bro. Wickens, seconded by Bro. Kastella and carried, that the thanks of the Executive and delegates of the C.A.S.E., be hereby tendered to the Mayor, Council and citizens, also the President and members of the Board of Trade, President and members of the Syderham Club of the city of Owen Sound for the extremely cordial treatment collectively and individually received from one and all, also the officers and members of the local lodge.

The closing ceremony then took place, when the delegates and their lady friends joined hands and sang "Should Auld Acquaintance be Forgot."

PROGRESS IN NEW EQUIPMENT

There is here provided in compact form a monthly compendium of the power plant manufacturers' achievements.

MICARTA.

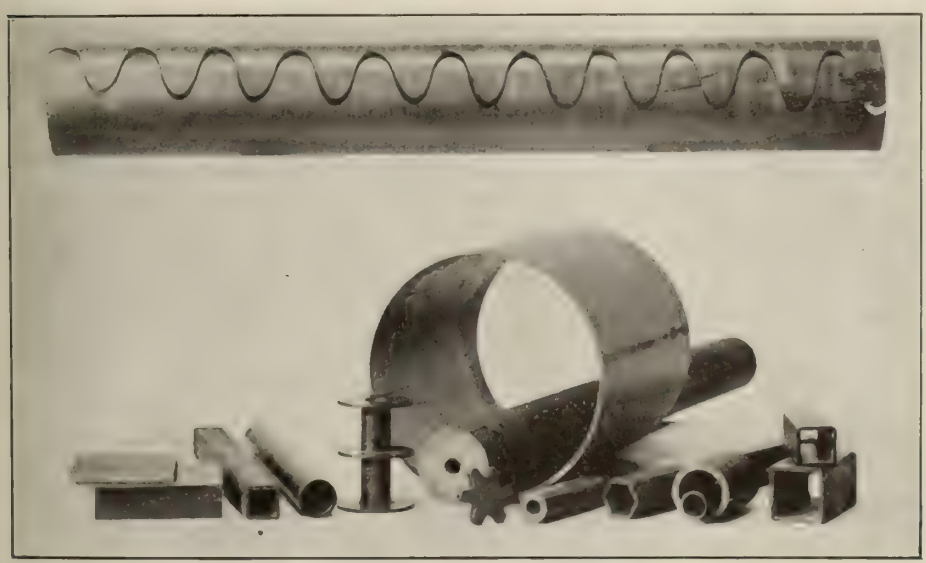
A REMARKABLE new material, known as Micarta, which is claimed to take the place of hard fibre, glass porcelain, hard rubber, built-up mica, pressboard, rawhide, moulded compounds, etc., has been developed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. It is used for commutator bushings and brush-holder insulation, as noiseless gear blanks, as conduit for automobile wiring, as spools for spark coil and magnet windings, for refillable fuse tubes, for wireless coil eparators, for arc shields in circuit-breakers, for water-meter discs, etc.

Micarta is a tan-brown colored, hard, homogeneous material having a mechanical strength about 50 per cent. greater than hard fibre. It can readily be sawn, milled, turned, tapped, threaded, etc., if a sharp pointed tool be used, and if the work be done on a lathe. Micarta is not brittle and will not warp, expand or shrink with age or exposure to the weather, but takes a high polish, presenting a finished appearance.

Two grades of the material are made. The grade known as Bakelite Micarta will stand a temperature of 150 degrees C. continuously, or 260 degrees C. for a short time. It is infusible, and will remain unaffected by heat until a temperature sufficient to carbonize it is reached. Heat will not warp Bakelite Micarta, and it will stand an electric arc better than hard fibre, hard rubber, built-up mica, or any moulded insulation containing fibrous or resinous materials. Its coefficient of expansion is low, being approximately .00002 per degree C.

Bakelite Micarta is insoluble in practically all of the ordinary solvents such as alcohol, benzine, turpentine and weak solutions of acids and alkalis, hot water and oils. It is indifferent to ozone—an advantage over hard rubber, resins, etc., for electrical purposes. It is non-hydroscopic and impervious to moisture. The other grade designated as No. 53 Micarta has the same mechanical and electrical properties as the Bakelite Micarta, but differs in its chemical and thermal properties. The plain Micarta behaves toward chemicals and heat very much as an ordinary resin. This grade is not used in plate form.

As proof of the uniformity of structure of Bakelite Micarta, the accompanying illustration of a fracture is shown. This is not a saw cut, but a natural break. The tube was held tight on a metal mandrel and a compressive force was applied at one end. When the force became sufficiently great the tube split as shown. The uniformity of the wavy fracture shows how homogeneous the material is. Such a break is known as a "harmonic fracture." It will be seen from the illustration, made from an actual photograph, that the strain followed the true harmonic wave almost as closely as the eye can detect, indicating that every part of the material was exactly as strong as every other part.



NATURAL BREAK IN BAKELITE MICARTA TUBING.
SAMPLES OF MICARTA PARTS.

IMPROVED AUTOMATIC WATER GAUGE.

THE improved automatic water gauge here illustrated was designed and patented by The Lunkenheimer Co., of Cincinnati, Ohio, who are its sole manufacturers. We understand that quite a large number are already in use, and that they are giving perfect satisfaction.

The water gauge is made in two patterns, termed "Medium" and "Extra Heavy," intended for 200 and 300 pounds working pressures, respectively. They are made either right or left hand, as desired, to facilitate operation.

Broken Glass Provision.

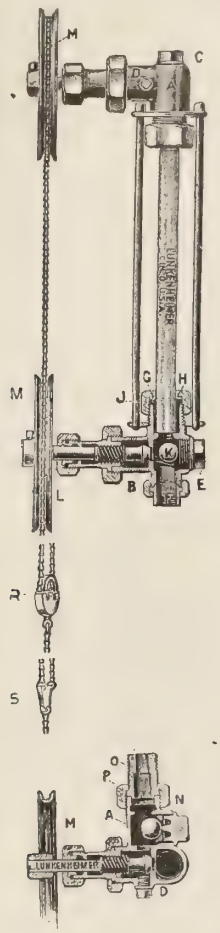
Should the gauge glass break, the ball check valves (K) will automatically seat themselves, owing to the rush of steam and water on one side, and the lack of pressure on the other. This automatic closing feature is a valuable one, as it prevents the escape of steam and water, and permits the safe closing of the hand operated valves for the purpose of renewing the glass.

To renew the glass, it is only necessary to loosen the stuffing-boxes (G), take off the cap (C), remove the broken glass and substitute a new one, after which the stuffing-boxes are tightened, and the cap (C) replaced. The change can be performed with perfect safety, for, owing to the quick-closing valves, which should be closed upon the dis-

covery of the broken glass, there is no danger to be anticipated from escaping steam and water.

The Cleaning Feature.

Particular care has been exercised in the design of the gauge to facilitate cleaning, and access can be readily had to any part. The plugs (C), (D), (E) and (N) are provided for this purpose. By removing the plugs (D) and opening the regrinding valves to their greatest extent, a rod can be inserted entirely through the body and tail pieces, and



IMPROVED AUTOMATIC WATER GAUGE.

any sediment that might have collected in or around the entrance of the tail pieces can thereby be easily removed. By unscrewing plugs (E) and (N) the check balls will of their own accord fall from the body, as they rest on inclined surfaces.

Valves Closing Feature.

It has been the practice heretofore to attach both pulleys together by means of a chain or cord, which was pinned to the pulleys, so that the proper closing of one depended entirely on the other. While in some cases this method was satisfactory, it has been found that unless great care was exercised in pinning the chain to the pulleys, or after the valves had been reground several times, one of the valves would not seat properly. To overcome this difficulty, the arrangement illustrated herewith was designed, by which it will be readily seen that both valves can be made to positively seat independently of each other.

The arrangement consists of a block pulley operating over a chain, which is pinned to both the upper and lower pulleys, this method being employed for closing the valves. Should one of the valves become closed before the other, a continued pull on the block chain will close the other. To the left of the pulleys the chain is merely attached to a triangular plate, as the opening of the valves need not be regulated to as fine a degree as the closing thereof.

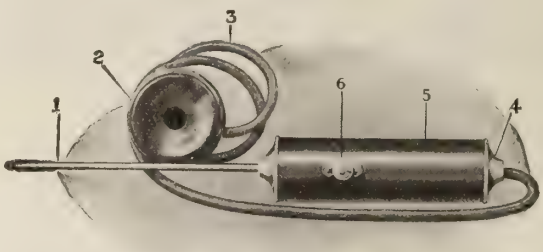
The valves are constructed on the same principle as the Lunkenheimer well known regrinding valves; therefore, they can easily be reground when worn. The valve seat opening is very large, and consequently a free and unobstructed passage for the water and steam is insured. The gauge cannot show a false level, as the ball checks are so constructed that unless the glass breaks, they will, owing to their weight and position, fall away from their seats.

The Lunkenheimer Company has issued an attractive booklet thoroughly describing and illustrating this gauge, which they are distributing free to anyone desiring a copy. The gauge has been given the trade name of "Monitor."

THE DETECTORPHONE.

AN instrument that is, perhaps, not as often met with in Canadian power plants as it deserves to be is the detectorphone, an illustration of which appears herewith. As may be seen from the cut, the instrument is an electrical device consisting of a telephone receiver (2), and an extremely sensitive microphone enclosed with a dry battery in a tube (5). Connected with the microphone is a steel rod (1).

The detectorphone is used to investigate conditions existing inside engine cylinders, water pipes, condensers, etc. A small knock that would otherwise be quite inaudible is greatly magnified by the microphone, enabling the engineer to form an accurate opinion of what is going on in the cylinder, valve chest, or other part under investigation. In using the instrument the rod (1) is held against the cylinder, etc., and the receiver (2) is applied to the ear, enabling the minutest sound to be clearly heard.



THE DETECTORPHONE.

It is claimed that a very little practice with the detectorphone renders an engineer wonderfully expert at diagnosing engine ills. By its use small troubles may be early detected and remedied, whereas, if their existence were unsuspected, they might steadily increase until a serious breakdown occurred.

The detectorphone is handled in Canada by the Maihak Indicator Agency, 3 Beaver Hall Square, Montreal.

THE CO_2 THERMOSCOPE.

MANY articles have appeared in the technical Press both of this Continent and the Continent of Europe relative to the importance of controlling furnace combustion in steam boilers by the analysis of the resulting gaseous products, and many descriptions have appeared of the various means by which this may be done.

As is well known, air, in excess of that which is required to ensure complete combustion of the fuel under a boiler, carries away heat wastefully to the chimney, and the boiler and its flues are less efficient in absorbing the heat which has been produced. An insufficient supply of air, again, causes inefficient combustion and waste of heat. Engineers, therefore, test flue gases for carbonic acid, because an unduly small or an unduly large proportion of it indicates uneconomical combustion. This is generally done by ascertaining the reduction in volume of the flue gas after treatment with a solution of caustic soda.

Importance of "Indicating."

The apparatus usually employed is known as the orsat, and being of glass construction and provided with delicate glass taps, burettes, etc., it requires much skill and careful handling to give accurate results. Engineers, as a rule, do not take kindly to the manipulation in the boiler room of laboratory appli-

ances, using caustic solutions and other liquids; therefore, CO_2 readings have not in the past been made by them to anything like the extent commensurate with the advantages resulting from such observations.

Steam engines are frequently indicated, and it is equally important, if not more so, to "indicate" the performance of the boiler by ascertaining the quantity of CO_2 in the waste gases. With the instrument shown, this "indicating" can be done with perfect facility, and without the use of water or corrosive chemical solutions, while the manipulation of the appliance is so simple that it can be successfully used by the most inexperienced operators.

Thermoscope Principle.

The CO_2 thermoscope makes use of a well-known principle of thermo chemistry, but one which has not heretofore been applied in the analysis of gases, viz: that chemical reactions are attended by a change of temperature, and that the amount of heat either absorbed or disengaged is determined by the nature of the reaction, and the quantities of the substance which enter into combination.

When carbonic acid (CO_2), either pure or in admixture with air, is brought into contact with caustic soda, a chemical reaction takes place, and heat is evolved. The amount of this is strictly proportional to the quantity of CO_2. If, therefore, a measured quantity of the gas mixture to be analysed is brought into contact with caustic soda, the amount of which being somewhat more than sufficient to absorb all the CO_2 present, it is only necessary to measure the heat evolved to obtain a measure of the CO_2 in the mixture. The caustic soda is prepared for use in hermetically sealed metallic capsules or cartridges, a fresh cartridge being employed for each analysis. The heat reaction is produced by passing a known quantity of the gas mixture to be analysed through the contents of the cartridge, while the amount of heat disengaged is measured by means of a specially constructed calorimeter thermometer, using a scale empirically calibrated in percentages of CO_2.

Detail of Thermoscope.

Having now described the general features of the CO_2 thermoscope and the principle upon which it operates, which, by the way, will be recognised by chemists and others as quite new in gas analysis, the following detailed description of the instrument will be of interest. The instrument consists of three essential parts, as follows:—

A cylinder, fitted with a plunger for drawing a measured quantity of the mixture from the flue or chamber containing the gas mixture, and subsequently passing it through.

A cartridge-shaped receptacle containing pulverised caustic soda, in which the heat reaction occurs.

A thermometer, with its bulb constructed to surround or jacket the cartridge, so that the heat of reaction can be imparted to the mercury, the amount of its expansion—the percentage of CO_2, to be observed on a movable scale.

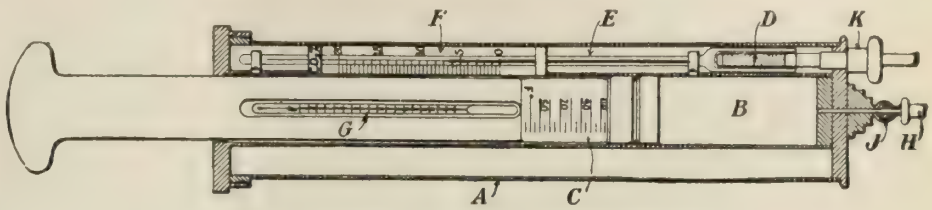


FIG. 2. CARBONIC ACID GAS THERMOSCOPE.

With the exception of two thermometers, the instrument is made of brass and hardwood, of robust construction, and capable of standing hard usage. It is 10 inches in length and 2 inches in diameter, so that it may even be carried in the pocket. Thus, an engineer may visit his boiler room with a few cartridges in one pocket, the CO_2 thermoscope in the other, and, without the necessity of setting up and adjusting any apparatus, obtain accurate analysis of the CO_2 from a range of boilers in the course of very few minutes. When finished with the instrument, it requires no washing or cleaning. It is simply put back into its leather case, and is ready again for instant use the next day, or the next month, as the case may be.

FIG. 1. CARBONIC ACID GAS THERMOSCOPE.

By reference to Fig. 2 it will be seen that (B) is a cylinder fitted with a piston and cup leathers. The thermometer (E) is conveniently mounted on the cylinder (B), and the whole is enclosed by the outer cylindrical metallic jacket (A), slotted to show the stem of the thermometer. A movable scale (F)

calibrated in percentages of CO_2 is arranged to slide in the slot, while (D) is a cartridge of thin sheet metal containing the pulverised caustic soda, and is shown jacketted by the thermometer bulb in position for an analysis. Connection is made between the cylinder and cartridge by means of the rubber tube (H) attached to the tap (J). In order to correct the volume of the gas taken into the cylinder for varying room temperatures, the length of travel of the piston is regulated according to the temperature, as shown on the thermometer (G) by the scale (C) engraved on the piston rod.

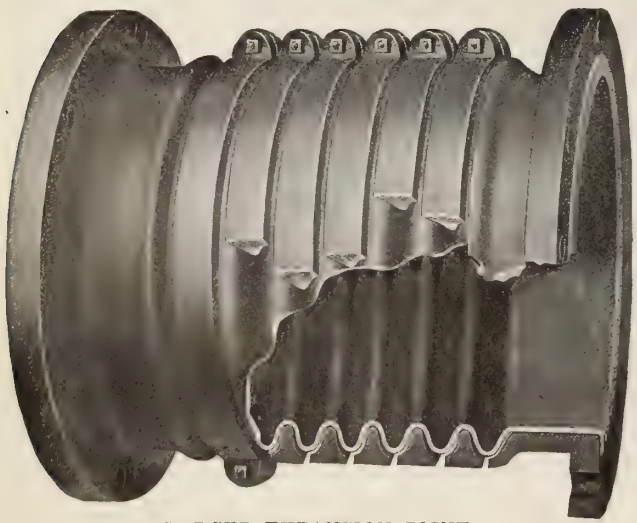
To Make an Analysis.

A cartridge is pricked at each end to enable the gas to flow through, being attached to the rubber connection and inserted in the thermometer bulb. A sample of gas is drawn into the cylinder, the necessary temperature correction being made, and the free end of the rubber tube is connected to the cylinder nozzle. The zero of the movable scale is adjusted opposite the top of the mercury column of the thermometer, and the piston rod is depressed. The gas mixture flows through the cartridge, heat is generated, the mercury rises, and opposite the highest point reached by the rising column may be read from the scale in plain figures the percentage of CO_2. The instrument is supplied in a cylindrical leather case, and is accompanied by a box of 100 cartridges.

Correct Proportion of CO_2.

So much has been written recently as to the correct proportion of CO_2 to be maintained in the furnace gases under varying conditions, such as nature of fuel, rate of combustion, and temperature of escaping gases, in order to obtain the maximum economy, that to digress thereupon seems outside the scope of this article, which has mainly for its purpose the description of a new and convenient method of analysis. It may be stated, however, that under average conditions, with the furnace gases leaving the boiler at, say 450 degs. F., an extended experience indicates that the best result will be obtained by maintaining the CO_2 at as nearly as possible 12 per cent.

The CO_2 thermoscope is manufactured by the Underfeed Stoker Co., Ltd., of Coventry House, South Place, London.

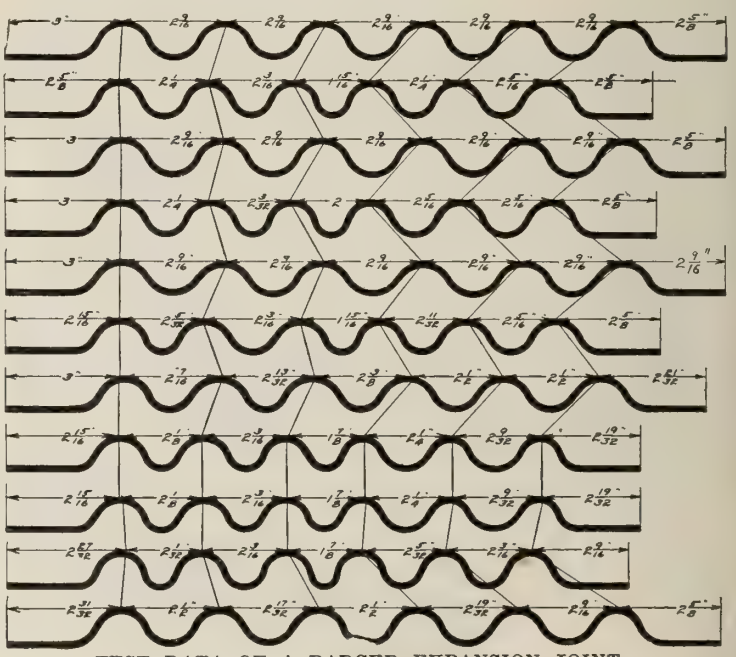


BADGER EXPANSION JOINT.

TEST OF A BADGER EXPANSION JOINT.

THE Badger Self-Equalizing Expansion Joint is distinctively a copper joint, corrugated for strength and for taking up the changes in pipe length. The external rings fitting the corrugations add strength to the joint and distribute the change of shape, each ring forcing a part of the change to the next so that the strain is divided among many corrugations, instead of being taken by one or two. It is evident that if the changes of shape are subdivided and distributed instead of concentrated the copper will last much longer. How well the Badger distributing rings pass along the strains, equalizing them among a large number of corrugations, is shown by a recent commercial test. The Badger expansion joint was sent for acceptance to a very large manufacturing concern, and having facilities not possessed by small companies, this large plant subjected the joint to searching tests. Approximate working conditions were available, and the accompanying figure shows the results graphically, the actual measurements being shown as well as the relative changes of shape.

The joint was a big one, 20 inches in diameter and 23¼ inches long between flanges. It had seven corrugations or depressions, and in order to have the joint heated nearly to working temperature it was filled with steam at about five pounds pressure. For testing, the joint was secured at one flange and shortened the desired amount by bolts. In this manner, the joint was shortened as it would be when squeezed together by the increase in length of two lines of pipe.



TEST DATA OF A BADGER EXPANSION JOINT.

PETROL SUBSTITUTE FOR AUTOMOBILES.

A DISCOVERY which it is claimed will revolutionize the motor spirit industry and make Great Britain partly independent of foreign supplies is announced by a joint committee appointed some time ago by the Royal Automobile Company and other automobile associations. The secretary of the committee says they tested a substitute for petrol, which is a by-product of coal, and which hitherto has been unsuitable as motor fuel. The expert of the commission made the fullest investigations, with excellent results.

A big commercial plant is now being built, and indications are that, when the process is fully going, forty million gallons will be produced. It can be sold at 28 cents a gallon, as compared with the present price of 42 cents. It is figured that the present British consumption of petrol is 100,000,000 gallons a year.

Nearly 1,000 girls are being taught to operate electrically driven machinery in a New York trade school.

The Lure of the Machinery Hall at the 1913 Exhibition

Staff Article

Being an account of things and men, at the Canadian National Exhibition, Toronto, who attracted unusual attention in the Machinery Hall, but laying no claim to cover the big field or all the exhibits found inside that building.

TO thousands of people in Ontario the Machinery Hall at Toronto Exhibition provides an opportunity to get in touch annually with the many utilities on which they are so dependent, and yet understand so little. To the average man it is a most uninteresting affair this Machinery Hall, but he usually takes it as he does his annual bath, as something that should be gone through at least once. One wonders what all those people who pass through this section of the Exhibition find to interest them in roll after roll of leather belting, etc. There are some wiser than the others, who know that the average man will stop and look at something spectacular, even when the mind fails to grasp the meaning of it; so The Canada Metal Co., with their tiers of babbitt and other metals, attracted big crowds by means of an electrical display portraying a workman pouring babbitt metal.

Then the electric welding machines and the experiments conducted by L'Air Liquide Society were great attractions. Of the former, The Fisher Motor Co., of Walkerville, and the Chapman Ball Bearing Co., Toronto, each had one, while, on the latter, experiments were conducted behind blue sheet glass, so as not to injure the eyes of spectators.

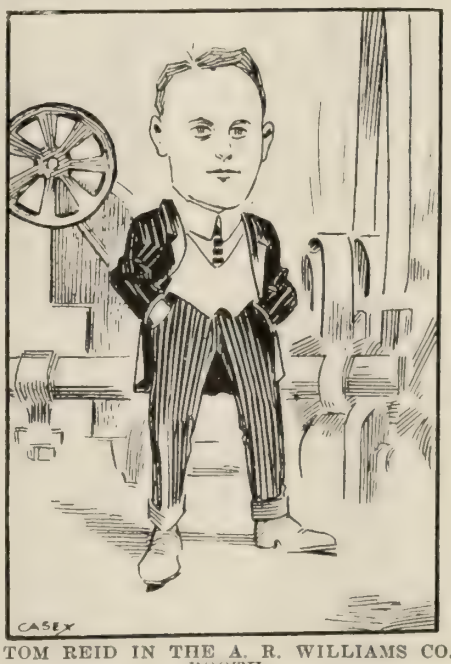
Things Brand New.

Of things brand new in the Machinery Hall, the newest was probably a Brown, Boggs press, equipped with a universal safety device. It was operated in the A. R. Williams Co. section by the inventor, J. Wright, a Hamilton man, and a first-class mechanic. He is superintendent of the E. T. Wright Co., Ltd., Hamilton, makers of tinware and galvanized iron products. He, with William S. Stacey, will superintend the manufacture of these machines. This is the first on the market, and was rushed specially for the Exhibition. The invention is simply a device to save the operator's fingers, and is very effective.

Electric Welders and Ball Bearings.

The chief exhibit of the Fisher Motor Co. was an electric welder, which opens wide the mouths of country visitors. It is difficult to figure out who is the Fisher Motor Co., since they have not been in this world long. The electric welder is the product of Fred W. Vollans, a prominent Walkerville engineer, who originated the F. W. Vollans Machine Co. The Fisher Motor Co. are manufacturers of motor trucks, and as this company was reported last week to have bought out the Tudhope Motor Co. of Orillia, Ont., their products will now number three. Both F. W. Vollans and Frank E. Fisher were at the "Ex." at various times. The electric welders were in charge of W. H. Smith. He reported giving exhibitions to spectators, who turned out to be clever American engineers, and were in Toronto simply for what they could pick up in the way of ideas. Other exhibitors have remarked this.

The Chapman Ball Bearing Co. secured as advantageous a position as there was in the building, and made good use



TOM REID IN THE A. R. WILLIAMS CO. BOOTH.

of it. Besides the customary display of steel balls forming the word Chapman, there was an electric welding machine in charge of Mr. Agnew, of the Canadian Welding Co., Walkerville, Ont., used for making the cages in which the balls are housed. W. J. Murray was in charge.

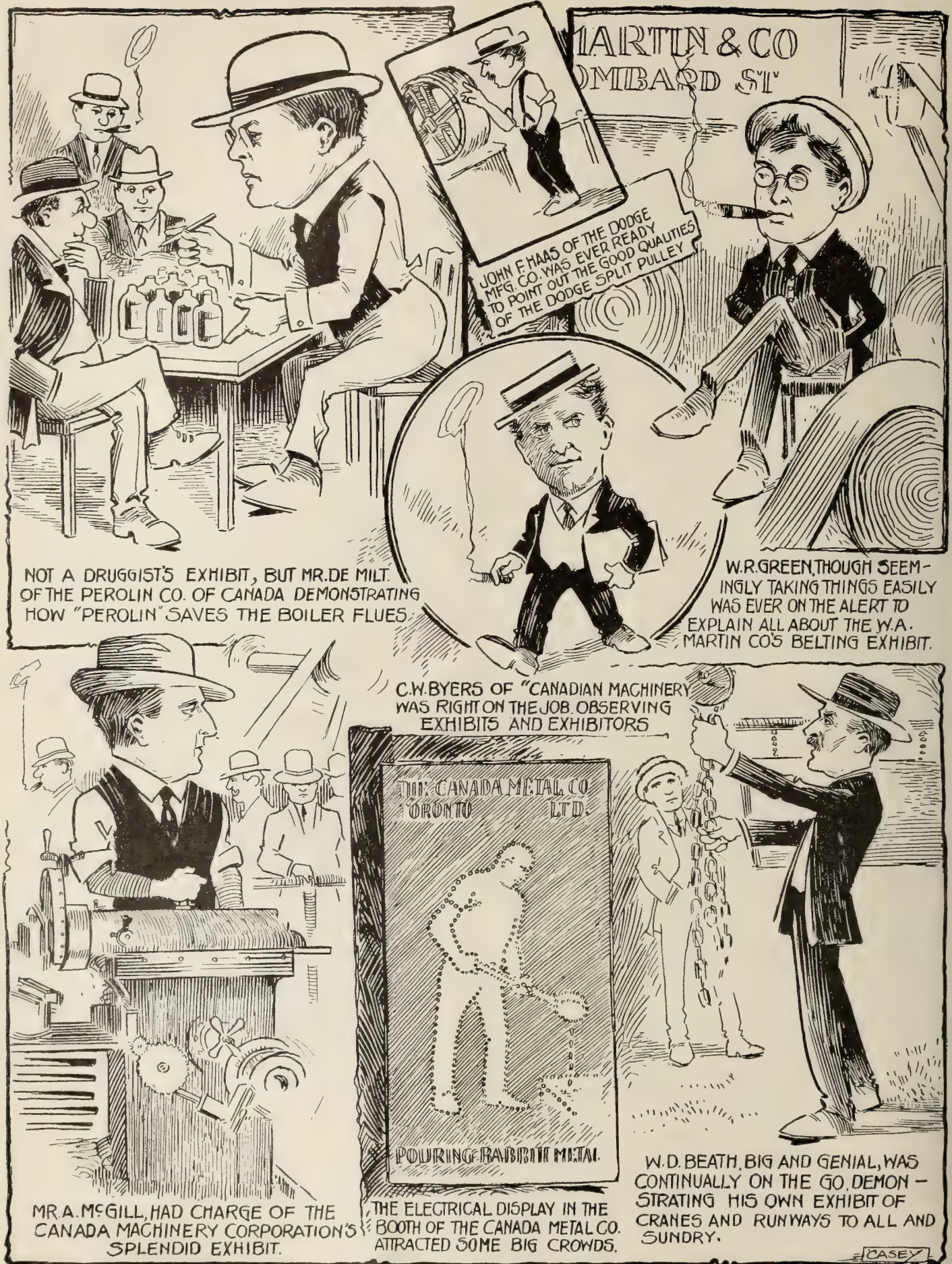
Machine Tools.

If the exhibit of the A. R. Williams Co., of Toronto, had been taken out of the Machinery Hall there would have been a big vacant spot, and one of the most interesting exhibits to the man in the street would have been lacking. This was the demonstration on a Warner & Swasey universal hexagonal turret lathe. Frank Castle travels around with the company's machines, and it was he who gave a special show on chucking work at the "Ex.," demonstrating how work could be done in 20 minutes which would take two hours and a half on an engine lathe. W. E. Marshall represented the firm of Warner & Swasey, and T. P. Burton was in charge of Williams' exhibit, which was very extensive. Messrs. Williams, Hollinrake and T. Reid paid visits to the Hall when circumstances permitted them.

A colored boy was employed by the Borden-Canadian Co., Toronto, to show the visitors how easy it is to operate their die stocks. He was a sort of help to J. Monaghan, who was in charge. Some old farmers found they were not so strong as the colored boy.

There was a line of shafting carrying immense pulleys in the Canadian Fairbanks-Morse Co. booth, but where the power to operate this came from no one could make out. To those who made enquiries, R. H. Noble, who was in charge, pointed to a sixteenth of a horse-power motor, connected by a piece of string. He added that the shaft was two inches out of line, but this was taken care of by the self-aligning feature of "Skefko" ball bearings, on which it was running.

When an artist on the staff of "Canadian Machinery" stood near the booth of the Canada Machinery Corporation and commenced making a few graceful curves in his notebook there was a figure appropriately enough pointing out the good qualities of a shaper. When it was all over, he saw the artist, and moved away. It was the modest A. M. McGill, Toronto representative of the C. M. C. He was in charge of the exhibit during the week, and was aided at various times by several others from the shops at Galt. Among those noticed around were B. H. Niel, purchasing agent; V. Boyd, sales manager, who called on Saturday, and "Bill" Baird, the South-west Ontario representative, who has been twenty-one years with the company. Besides a number of woodworking tools, Mr. McGill was showing a 20 x 12 engine lathe, and a 24 x 30 shaper. He remarked that several American machine tool men had visited the exhibit, and had expressed surprise that such fine products could be turned out on this side. Incidentally, the C. M. C.


MARTIN & CO
OMBARD ST
JOHN F. HAAS OF THE DODGE MFG. CO. WAS EVER READY TO POINT OUT THE GOOD QUALITIES OF THE DODGE SPLIT PULLEY
NOT A DRUGGIST'S EXHIBIT, BUT MR. DE MILT. OF THE PEROLIN CO. OF CANADA DEMONSTRATING HOW "PEROLIN" SAVES THE BOILER FLUES.
W.R. GREEN, THOUGH SEEMINGLY TAKING THINGS EASILY WAS EVER ON THE ALERT TO EXPLAIN ALL ABOUT THE W.A. MARTIN CO'S BELTING EXHIBIT.
C.W. BYERS OF "CANADIAN MACHINERY" WAS RIGHT ON THE JOB, OBSERVING EXHIBITS AND EXHIBITORS
THE CANADA METAL CO. LTD. TORONTO
POURING BABBITH METAL
MR. A. McGILL, HAD CHARGE OF THE CANADA MACHINERY CORPORATION'S SPLENDID EXHIBIT.
THE ELECTRICAL DISPLAY IN THE BOOTH OF THE CANADA METAL CO. ATTRACTED SOME BIG CROWDS.
W.D. BEATH, BIG AND GENIAL, WAS CONTINUALLY ON THE GO, DEMONSTRATING HIS OWN EXHIBIT OF CRANES AND RUNWAYS TO ALL AND SUNDRY.
CASEY

WHAT IMPRESSED CASEY IN THE MACHINERY HALL OF THE CANADIAN NATIONAL EXHIBITION.

is turning out a lathe per day, and is not grumbling at poor trade.

Machinery Accessories.

Crescent belt fasteners were to be found at almost every booth in the hall where belting was on sale, but the makers had a special representative at the booth of W. A. Martin & Co. in the person of Herbert Walker. Mr. Martin used to represent the Canadian British Engineering Co., Ltd., in Toronto, but has now taken over that concern's operations for the whole of Ontario, and will open new premises at 70 Lombard Street, carrying a full stock of tool steel, electrical equipment, gas engines, leather and Gripoly belting, Graton & Knight belting, and air compressors. Associated with Mr. Martin is W. R. Green, the sales manager, a young American engineer of great promise. He was in charge of the firm's booth.

The Garlock Packing Co. of Hamilton drew the attention of the passers-by by means of a supply of Keystone grease circulating in a motor car gear box, run by a small electric motor. H. G. Fletcher represented Garlock, and in the same booth was a supply of Lunkenheimer engine specialties, in charge of E. A. Wilkinson.

Kester T. Barr, manager of the Lumen Bearing Co., Toronto, was a familiar figure at the "Ex.," his firm having a splendid exhibit of drop forgings. J. K. Young, master mechanic of the die casting department, did considerable explaining, astounding the farmers with his marvellous figures. "No machine work," he explained; "just as it leaves the die, and true to a thousandth part of an inch. The metal is subjected to a pressure of 200 lbs. to the square inch." And so on.

J. B. Faatz represented Cling-Surface Co., Buffalo, N.Y., and his catch was a lifebelt bearing the words: "Cling-Surface life-saver for belts." Not a bad idea.

John F. Haas wasn't giving anything away, but he would spend his valuable time explaining how Dodge pulleys were made, and how they were superior to other makes. Incidentally he was not the only one there in this line. The Positive Clutch and Pulley people had a booth, and Reeve's pulleys were shown in the A. R. Williams exhibit.

The Canadian Pneumatic Tool Co. did not excite much interest in their electric headlight for locomotives. Truth to say, there were not many people there who used locomotives, but J. B. Wilson, the Ontario representative of The Holden Co., Ltd., did his best to educate the spectators in the use of electric and compressed air drills. He also had a new portable electric grinder for engine cylinders, just on the market.

W. D. Beath, maker of cranes and runways, was present in person at the Exhibition to show his wares. He found more farmers than foundrymen looking around, but there were quite a number of the latter who were interested in his well-known creations, some of which are quite new. W. D. Beath caters to such a wide trade, that he was kept continually on the go.

There were plenty of others at the "Ex." of greater or lesser note. There was Mr. De Milt, of the Perolin Co. of Canada, looking like a druggist with his bottles, showing to groups of eager spectators how Perolin saves the boiler flues. The Dearborn Chemical Co. had a representative there for the same purpose.

Humorous Side to the "Ex."

Quite a lot of people who visit the Toronto Exhibition go there to see what they can pick up in the way of samples. It is rather difficult for machinery men to oblige them in this. Lathes, belting and cling-surface are not handy things for souvenirs; but there was one man in the Machinery Hall who did give away souvenirs. Whenever a visitor asked for something along this line, he or she was generally directed to a certain booth. "Do you give anything away?" was the question usually put. "Yes," replied the machinery man, "I have some ladies' coat hangers. Will you take one?" Nobody ever refuses a coat hanger, so the reply was in the affirmative. The Machinery Hall rocked with laughter every time a couple of six-inch nails were handed over.

Something went wrong with the clothing of one of the lady visitors as she passed through the Machinery Hall. Whatever it was, it worried her considerably. When she and her escort arrived at the booth where a certain famous leather belt fastener was being boosted, a splendid idea struck her. Leaning over to the attendant, she asked if these fasteners were for ladies' belts, and could they be attached to the hose? The engineer blushed, and quietly explained the situation.

The machinery men were genial fellows on the whole, but one there was among them handy with his fists and of unusual physical proportions. He went out for dinner, and ordered fish as a side. He made sure from the waitress that fish was not an extra, but when the meal was over an extra ten cents was charged. The caterer made an effort to secure the dime, and only relaxed his efforts when the machinery man threatened to clean up the show.

J. K. Young, of the Lumen Bearing Co,. was giving away exact reproductions of locomotive bearings, one-twentieth of the original size. Visitors were told to put these in their pockets, as if they lost themselves these would enable them to find their bearings again.

By the time nine o'clock p.m. was reached, most of the booths in the machinery section were vacant. There were spectators, however, who lingered around until ten o'clock looking for sparks flying, and wondering why the electric welders were not at work. At that hour an officious little man, backed by a couple of policemen, came around and bustled everybody out, no matter how important the business being done.

STEEL BELTS.

WHEN most manufacturers and owners of factories are looking for new methods of reducing the ever-increasing initial costs and getting a better return for any outlay, says "The Engineer and Iron Trades' Advertiser," it is not surprising that the potentialities of steel belt transmission in these directions are beginning to be appreciated. Though more than six years have passed since the "Eloesser" system was introduced on the continent of Europe, and over 100,000 h.p. has since been installed there, it is only lately, that a few of the more daring firms have ventured to adopt the system.

The belts are made from a specially hardened charcoal steel prepared by a secret process, and the finished material has a tensile strength of 95 tons per square inch. The length of each belt is constant, and no subsequent readjustment is required. Thicknesses vary from .2 to 1 mm., and the widths from 1½ in. to about 8 in., according to working conditions and the maximum h.p. to be transmitted. The tension required on the belt over flat or rope converted pulleys is determined by a special patented instrument, and only one flexible steel joint—designed so that its rigid portion does not hinder transmission—is necessary.

Since being perfected, no breakages have occurred at this joint, indeed the only breakages (caused mostly through faulty alignment of shafting or pulleys) during a whole six years' running have been less than one per cent. over all the installations. Once tension requisite to transmit the required horse power is determined, the length remains constant, there being no appreciable stretch; but so that metal does not run to metal, and to take up any possible slip, a friction coating consisting of a layer of canvas, to which is glued fine sheets of cork, covers the rims of the pulleys. Thus, the slip is very low, and consequently a very high transmission efficiency can be guaranteed.

Under several conditions, the system is unsuitable, but for continuous drives above 10 h.p., no matter how close or distant the centres, whether horizontal, vertical, or tangential drives, the system has many advantages.

Machinery Display at the Canadian National Exhibition

Staff Article

The variety, quantity and quality of the machinery exhibit at the Canadian National Exhibition, in Toronto, for this year, 1913, the enthusiasm displayed by those represented by, and in charge of, the different lines shown, and the evidently increasing interest taken by the public in this important feature of our National development and achievement, go to show that those responsible for the direction of the undertaking as a whole would be consulting the popular demand and manufacturers' desire, were immediate steps taken to provide accommodation commensurate with the place and part which machinery occupies and plays in our country's upbuilding.

The Lumen Bearing Co., Toronto had a large number of die-castings on view.

The Wells Pattern & Machine Works, Toronto, showed a full line of foundry chaplets.

The Jones & Moore Electric Co., Toronto, showed a number of "Century" electric motors.

The Augustine Automatic Rotary Engine Co., Toronto, exhibited several of their rotary type engines.

The Brownwall Engine and Pulley Co., Lansing, Mich., showed several gasoline engines in operation.

MacDonald & Sons, Ltd., Toronto, showed steamfitters' supplies, such as pipe threaders and wrenches.

The Ontario Wind Engine and Pump Co., Toronto, showed a number of "Chapman" gasoline engines.

L'Air Liquide Society, Montreal, were demonstrating their oxy acetylene process for welding and cutting metals.

The "Honest Injun" Motor Co., Toronto, were represented by a number of their "Honest Injun" gasoline engines.

The George B. Meadows Co., Toronto, were located in the Industrial Building, and exhibited their "sure grip" metal lockers.

The Dennis Wire and Iron Works, Ltd., London, located in the Process Building, had on show examples of their metal lockers.

The Cling-Surface Co., Buffalo, were distributing literature and demonstrating the merits of their well known belt dressing.

The Can. Fairbanks-Morse Co., Toronto, had an exhibit in the Agricultural Section, consisting of gasoline engines, scales, etc.

The Positive Clutch and Pulley Co., Toronto, showed a number of their wood rimmed pulleys with pressed steel spokes malleable iron hubs.

The Massey Harris Co., Ltd., Toronto, showed a number of oil engines, driving pumps and demonstrated a power spraying apparatus for farm work.

The Dominion Belting Co., Ltd., Hamilton, had on hand supplies of their well known "Maple Leaf" brand of cotton duck belting and dressing.

Julius & August Erbsloh, Barmen, Germany, represented by the Canadian Aluminum Products Co., had a full line of aluminum products on view.

The British Aluminum Co., Ltd., Toronto, had a varied and interesting exhibit showing the many purposes for which aluminum can be employed.

D. K. McLaren Co., Toronto, exhibited a complete line of their well known "British" oak tanned leather belting, also steel split pulleys and mill supplies.

The Schaeffer & Budenburg Mfg. Co., Brooklyn, N.Y., were represented by a complete line of their well known pressure gauges and the "Resisto" gauge glass.

Jones & Glassco, Montreal, demonstrated the Renold silent chain drive. They had also a show case containing various sizes and sections of Renold chains.

The William Hamilton Co., Ltd., Peterborough, Ont., exhibited a "Samson" water wheel, a centrifugal type "stuff" pump for pulp mills, and some saw mill machinery.

The J. L. Morrison Co., Toronto, representing the Advance Machinery Co., were exhibiting several paper cutting machines for bookbinders, paper makers, printers, etc.

The Dearborn Drug & Chemical Co. of Canada, Ltd., Toronto, through their representative and printed matter, explained the merits of the Dearborn treatment of boiler feed water.

The Garlock Packing Co., Hamilton, had on hand a full line of their well known packings and greases. They were also showing Lunkenheimer valves and other of this company's specialties.

The Canadian Pneumatic Tool Co., Ltd., Montreal, showed an extensive line of "Duntley" electric tools, compressed air riveters, drills, etc. The "Fyle" steam-driven electric headlight for locomotives was also exhibited. The Holden Co., Ltd, Montreal, are the sales agents.

The Agnew Electric Welder Co., Ltd., Walkerville, Ont., exhibited an electric spot and butt welder, the former being in operation and welding Chapman ball bearing carriages as a demonstration.

Cowan & Co., Galt, Ont., showed a number of woodworking machines, such as a chain saw mortice, 12 in. moulder, 12 in. power feed rip saw, cross cut and mitre saw, and a vertical hollow chisel mortice machine.

The Fisher Motor Co., Ltd., Walkerville, Ont., were exhibiting the "Vollans" spot and butt electric welding machines, and showed the various classes of work that these machines are capable of handling.

The Borden-Canadian Co., Toronto, had a full line of their "Beaver" and "Premier" die stocks and pipe cutters. The latter are of new design, made in two sizes, and embody several new and distinctive features.

Canadian Quality Saw & Tool Works, Montreal, had a Robertson power hack saw machine for demonstrating in connection with their "Quality" hack saw blades. They also showed the "Jennings" expansive bit.

William C. Wilson & Co., Toronto, exhibited a full line of packings and mechanical rubber goods, the product of the Home Rubber Co., Trenton, N.S. The O.I.M. and N.B.O. packings were two of the principal features.

The Preston Woodworking Machinery Co., Ltd., Preston, Ont., exhibited for the first time and had a number of machines on view including a 36 in. band saw, 24 in. pony planer, 12 in. jointer and a variable feed saw.

The Canada Machinery Corporation, Galt, Ont., staged an interesting exhibit of metal and wood-working tools, the principal being a 20 in. engine lathe, 24 in. crank shaper, 12 in. four side moulds, 12 in. inside moulder, tenoning machine with cut-off saw, chain mortice and sash trimmer.

The Linde Canadian Refrigeration Co., Ltd., Montreal, P.Q., had an interesting exhibit in the Government Building, where they have a plant working in connection with the refrigeration system installed there for the protection of perishable goods.

R. A. Lister & Co., Toronto, had several oil engines in operation, the principal of these being the Lister-Bruston 40-light automatic electric lighting set, which is so constructed that the engine will begin to operate by simply turning on the lighting switch.

The Twin City Oil Co., Berlin, Ont., showed two novelties—one being the "Manzel" tire pump and the other the "Taber" boiler compound feeder. The former is attached to an automobile engine and the latter is an automatic device attached to the feed pump.

The Canadian Fairbanks-Morse Co., Toronto, exhibited their well-known line of transmission machinery including "Skefko" ball bearings, pulleys, hangers, grip nuts, belting ,etc. They had a shaft running in "Skefko" ball bearings to demonstrate the frictionless features of the latter.

The Canadian Morehead Mfg. Co., Woodstock, Ont., exhibited their well-known steam traps. A condenser trap with boiler feed, a non-return trap and a No. 6 return trap, were on view. This firm also handle the "Otis" feed water heater. G. W. Cole and E. I. Bickle were in charge of this exhibit.

The Dodge Mfg. Co., Toronto, had as usual an interesting exhibit of their well known line of power transmission machinery, including steel and split wood pulleys, bearings, hangers, etc. A wood pulley was to be seen showing clearly the method of manufacture. Mr. John F. Haas had charge of this exhibit.

The General Machinery Co., Toronto, exhibited the "Muncie" crude oil engine and Luitwieler pumps. The engine is of the semi-Diesel horizontal type, was operating a triplex pump. A vertical motor driven Luitwieler pump was also shown in operation, together with two other pumps operating a pressure tank system.

S. F. Bowser & Co., Inc., Toronto, had an exhibition in the Transportation Building and also in the Industrial Building. They were demonstrating the merits of the "Bowser" system for storing and distributing lubricating oils, gasoline, etc. Equipment noted included self-measuring hand and power driven pumps, tanks, oil filters, etc.

The Canada Metal Co., Ltd., Toronto, had an excellent display of their well known products, such as lead pipe, plumbers' supplies, copper ingots, zinc., spelter, as also samples of various brands of babbitt metals, including the Harris heavy pressure babbitt. One feature of this exhibit was an illuminated sign showing a man pouring metal.

W. A. Martin & Co., Toronto, showed an interesting line of engineering and mill supplies. The principal features were the "Gripoly" woven hair belting, "Neptune" and "Spartan" leather beltings, Darwin & Milner's high-speed steels. This firm represents the Canadian British Engineering Co. They also showed the "Callender" babbitt, phosphor bronze, etc.

H. L. Pieler Co., Toronto and Montreal, had a full line of Ashton valves, Mason regulators, and Bundy steam traps on view. Sharing the same stand were **The Engineering Specialties Co., Toronto,** who were showing their quick action blow-off valves, "Flexible" tube cleaners and Jefferson unions. A new appliance is the "Hardt" generator for hot water systems.

Keith's, Ltd., Toronto, had, in the Machinery Hall, an interesting exhibit, consisting of a refrigerating plant, complete with ammonia compressor, condenser and piping, etc. The compressor is a "Frick" machine of 6 tons capacity, of the vertical two-cylinder type, and was operated by a 10 h.p. C.G.E. motor. They also had an exhibit of electric fixtures in the Process Building.

The Boiler Repair and Grate Bar Co., Toronto, showed the 20th century shaking and dumping grate bar. Their booth was shared by **The Perolin Co., of Canada, Ltd.,** who handle "Perolin" for boilers. This is a comparatively new material on this market, and, while not, strictly speaking, a boiler compound, is used for preventing the formation of scale in boilers. Several exhibits are shown indicating its preservative effect on metal. Mr. S. De Milt was in charge of this stand.

The James Morrison Brass Mfg. Co., Toronto, were located in the Industrial Building, and had a full display of the various lines which they manufacture. Their products exhibited included steam and hydraulic pressure gauges, injectors, stop valves, engine counters, safety valves, engine-room telegraphs, etc.

The Northern Electric Mfg. Co., Montreal, had an attractive display in the Industrial Hall, exhibiting their telephones, fire alarm and electrical apparatus.

W. D. Beath & Son, Ltd., Toronto, gave demonstrations of their overhead industrial tracks and runways, one exhibit being an overhead track with a 3-way switch and cross over, both operated from the ground by chains; stops being fitted to prevent the trolley running into an open switch. A special type of trolley is used with this equipment. An overhead foundry track with a fixed switch was shown, the direction of the trolley being controlled by a stop placed in front which engages with the switch and is operated from the ground.

The A. R.Williams Machinery Co., Toronto, occupied their old stand at the western entrance of the Machinery Hall, and had on show a number of machine tools, including an "American" 16 in. high duty lathe, a "Barkey" No. 4 grinder, "Hanfield" presses, a Hendey Machine Co.'s No. 2 universal milling machine, a Smith & Mills 12 in. shaper, Herbert Morris Co. chain blocks, and a case of taps and dies by the Canadian Tap and Die Co., Galt, Ont. They were also demonstrating a Warner & Swasey universal hollow hexagon turret lathe. In another section they had an exhibit of motor boat engines.

The Chapman Ball Bearing Co., of Canada, Toronto, occupied considerable space in the centre of the Machinery Hall. Several interesting exhibits were to be seen, among these being a testing plant for demonstrating the saving in power that can be effected by using ball bearings as against the ordinary type. Pressure put on a shaft running in a set of ordinary bearings, by a hydraulic jack and readings taken from an ammeter show the amount of power absorbed. The same test is made with "Chapman" ball bearings. The comparative results record the difference in power necessary to drive the respective shafts.

OVERHEAD POLE STATISTICS.

STATISTICS of the number of wooden poles purchased in the United States in 1911 by steam and electric roads, electric light and power companies, telephone and telegraph companies are presented in a bulletin soon to be issued by the Bureau of the Census, Department of Commerce.

The total purchases of poles for 1911 amounted to 3,418,020 sticks of timber of which 70.3 per cent., were purchased by telegraph and telephone companies, and 6.7 per cent. by steam railways Cedar timber provided 61.4 per cent. of the total number of poles used, while the number of chestnut poles used has increased by 177,440 since 1908. The number of oak poles decreased 65,000 from the preceding year. The use of pine has increased very little since 1907, while the demand for cypress has fallen off each year. Of the total number of poles, 159,321 were creosoted entirely or in part.

POWER PLANT DEVELOPMENTS

A record of current municipal, manufacturing and general industrial projects, involving steam, gas, oil, electricity, air and water power equipment requirements.

Electrical

Estevan, Sask.—The council is considering extensive additions to the light and power plant.

Calgary, Alta.—The City Council is planning the erection of a power substation. George Craig, engineer.

Hull, Que.—The Ottawa & Hull Power Co. has started the erection of a large power house near the Chaudiere Falls.

Wadena, Sask.—The council will spend $16,000 for the erection and equipping of an electric light and power plant.

Carman, Man.—The Canada Tile and Fireproofing Co. will apply for a franchise to supply the town with electric light.

Montreal, Que.—The Halifax Electric Tramway Co. have issued new stock for extension and improvement of the system.

New Toronto, Ont.—The Ontario Hydro-Electric Commission has informed the council that the material for the proposed power and light system has been ordered.

Port Hope, Ont.—The Seymour Power Co., Toronto, will instal additional equipment costing $10,000. The ratepayers have granted them a ten-years' franchise to supply power.

Elk Lake, Ont. — The Miller Lake-O'Brien Mine is developing the water power near Gowganda, on the east branch of the Montreal River, and will use the power electrically at the mine at Miller Lake.

Ancaster, Ont.—The village sent a deputation to Toronto last week to meet Hon. Adam Beck, and secure information regarding Hydro-Electric power. Arrangements may be made with Dundas to provide power.

Toronto, Ont. — In connection with the steam reserve plant to be constructed by the local Hydro-electirc Commission Chief Engineer H. H. Cousens is investigating a proposal to utilize the exhaust steam for heating purposes.

Guelph, Ont. — North Wellington is taking up the hydro power question. Hon. Adam Beck will address a meeting in Elora and Fergus, both meetings being in the interests of hydro electric power installation in the two towns.

Quebec, Que.—Workmen are at present being employed by the Dorchester Electric Co. to put up poles and wires for an electric light service into Charlesbourg. The village expects to have an efficient electric light system within the next two weeks.

Brampton, Ont. — The Erindale Light & Power Co., has applied to the Toronto Township council for permission to raise $50,000 on property to complete dam and generate 500 more horsepower. At present, only 400 horsepower are generated.

Salmon, B.C.—A. H. Nairn, representing the contractor's setting up department and E. Hallgren, an expert from the builder's factory in Sweden, arrived here last week to set up the 200 h.p. Diesel oil engine, which will furnish the power for the city's electric light.

Toronto, Ont.—The Rice Hydra, Ltd., electrical contractors, 152 Bay street. have made an assignment to W. L. Martin A meeting of creditors will be held this week. The concern was a fairly large one, and had done some important work. The company will be reorganized under a new name.

Prince Albert, Sask.—The city council has decided to suspend operations to some extent on the La Colle Falls dam, owing to lack of funds. Excavations for the tail race and spillway will be continued. J. M. Voith, Heidenheim, Germany, was awarded the contract for power equipment for this scheme.

Toronto, Ont. —Cluster lights of 500 candle-power are to be placed over the centres of the roadways at the important corners in the city, the experiments of the Hydro-Electric Commission with them having proved a success. There will also be 300 candle-power clusters hung over the less important intersections.

Toronto, Ont.—To accommodate the many users of Hydro-Electric energy throughout the city, the Hydro Commission has found it necessary to build an addition to the transformer station on Strachan Avenue. The City Architect has issued the permit calling for the construction of a two-storey brick, steel and concrete building, costing $35,000.

London, Ont.—The hydro-electric department will show a surplus of $40,000 by the end of November, the close of the fiscal year. For the first half, it was $20,000, and the last part of the year has seen a great increase of business. The consumers now number nearly six thousand, and the amount of power sold is nearly 6,000 horse-power. As a result of this surplus, power rates will be reduced next year. It is the intention of the commissioners to supply energy at a price as near cost as it can be furnished.

Kamloops, B.C.—The Seattle branch of Chas. C. Moore & Co., engineers, has secured the contract for furnishing two 1,100 horse-power water wheels for the hydro-electric power plant to be constructed by this city. The Canadian General Electric Co. procured the contract for the switchboard and transformers and the Canadian Westinghouse Electric & Mfg. Co. the contract for the generators. Ducane & Dutcher, Vancouver, are the consulting engineers. Work will be done under direction of Charles C. Moore & Co.

Granby, Que.—C. J. McCuaig, of McCuaig Bros., Montreal, has made a proposal to the town to bring electric power from Drummondville, where he has acquired two power sites on the St. Francis River, capable of developing 8,000 horse power. He would buy out the present electric light plant and give a 24-hour service at the same rates as now paid, besides furnishing all the power required for manufacturing purposes. Mr. McCuaig will submit a proposition in writing to the Council and will meet them again so as to discuss the terms.

Water Works

Dundas, Ont.—The council are considering installing a pumping and filtration plant.

Melville, Sask.—The town council is planning the installation of sewage disposal works. The secretary is F. H. Clarkson.

London, Ont.—The city has finished the drilling of four artesian wells at a cost of $100,000. They yield 2,500,000 gallons per 24 hours.

Guelph, Ont.—The Nokros Union Co. will manufacture their products in Guelph, Ont., and expect to be ready for business about November 1.

Swift Current, Sask.—Bylaws to provide $80,000 for waterworks system and $28,500 for erection and equipment of fire hall have been passed.

Leaside, Ont.—At a meeting of the council last week, it was decided to raise $60,000 for a water-works system, and $60,000 for sewers. Mayor McCrea.

Stamford, Ont.—The municipality of the town of Stamford will instal a water plant, with stand pipe, pressure tanks, pumps and other accessories.

Calgary, Alta. — A. W. E. Fawkes, waterworks engineer, has planned a 44-mile pipe line to the Rocky Mountains. The whole scheme will cost over $1,000,000.

Lovette, Que.—This town will instal a fire protection system. It will get a $2,500 grant from the Government. The waterworks system will also be extended.

Coquitlam, B.C.—The work of the past four years, that of preparing for and constructing the 75-foot dam at the head of Coquitlam Lake by the Vancouver Power Co., is nearing completion.

Toronto, Ont.—That a site for a new reservoir in North Toronto is actually under consideration by the city is evinced by the activity on the old Gartshore property west of Yonge street and just north of Eglinton avenue.

Mirror, Alta.—The G. T. P. Railway will construct a pipe line between its water tank here and Buffalo Lake, anr will supply the town. A pumping station and reservoir will be built, the whole scheme costing $15,000.

Berlin, Ont.—President Wendt, of the Buffalo Forge Co., Buffalo, N.Y., has completed negotiations for the establishment of the company's Canadian branch in Berlin. Five acres of Woodside Park property have been deeded to the company on which a foundry will be erected this fall.

Toronto, Ont.—A recent water famine on the Island has proved the 6-inch mains there to be inadequate. It was designed to supply 500,000 gallons. Mayor Hocken is urging the installation of a better system, with bigger pumps.

Ottawa, Ont.—Following a recommendation from the waterworks committee, the city council has voted $57,000 for lifting, repairing and relaying the old intake pipe, and the tender of Loomis, McBean and Williams, Montreal, being the lowest, this firm was awarded the contract.

Quebec, Que.—A petition, signed by the Mayor of Sherbrooke, other towns, and also many leading merchants of the Eastern Townships, has been forward to Hon. Jules Allard, Minister of Lands and Forests of the Province of Quebec, requesting that storage reservoirs be constructed and operated at the head of the St. Francis River.

Toronto, Ont.—The John Inglis Co., Limited, engine and boilermakers, have prepared plans for the erection of a new plant on the old prison property, which is adjacent to a section of their present plant. The latter will be converted into a foundry, capable of making the largest castings. The new plant will measure 120 x 600 feet, and will comprise all departments to be found in an up-to-date general engineering works. The order for the steel has been given to a Montreal firm. Mr. Reaves is secretary-treasurer, and Wm. Inglis managing director.

Refrigeration

Ottawa, Ont.—The city is contemplating the erection of a civic abattoir.

Toronto, Ont.—The American Club is having a 1-ton "York" refrigerating plant installed.

Engleton, Ont.—Joseph Kilgour's residence is being equipped with a 3-ton refrigerating plant, furnished by the Frick Co., Waynesboro, Pa.

Toronto, Ont.—St. Augustine Seminary is being equipped with a 6-ton refrigerating machine, furnished by the York Manufacturing Co., York, Pa.

Niagara Falls, Ont.—Frank Douglas and Henry Campagne are considering the establishment of a cold storage plant here. The estimated cost is $50,000.

Toronto, Ont.—C. White & Co. are installing an 8-ton vertical single acting belt-driven enclosed type refrigerating machine and high pressure side complete, supplied by the York Mfg. Co., York, Pa.

Prince Albert, Sask.—The Saskatchewan Abattoirs, Ltd., is preparing to erect a cold storage and packing plant. James O'Callaghan is the managing director.

Vonda, Sask.—The Canadian Government has awarded the contract for construction of a warehouse with cold storage facilities at Vonda, designed especially for storage of meats.

Niagara Falls, Ont.—The Douglas Pure Ice Co. is erecting a new structure, to be equipped with machinery for the manufacture of ice. A 75-ton or 100-ton plant, it is stated, will be installed.

Berlin, Ont.—M. B. Rickert has purchased one 2-ton vertical single-acting belt-driven enclosed type refrigerating machine and high pressure side, complete, from the York Mfg. Co., York, Pa.

Toronto, Ont.—W. R. Perrin, consulting architect, and engineer of the civic abattoir, has been awarded the contract for supplying the interior fittings and machinery for the abattoir. His tender was $108,376.

Vancouver, B.C.—The Mainland Ice & Cold Storage Co., who are building a new cold storage house, have let the contract for installation of direct expansion piping for same to the Frick Co., Waynesboro, Pa.

The Arctic Ice Machine Co., Ohio, have recently booked the following orders:—St. Regis Hotel, Winnipeg, 1 ten-ton refrigerating machine for hotel use; St. Charles Hotel, Winnipeg, 1 ten-ton refrigerating machine for hotel use.

London, Ont.—The London Cold Storage Co., on Bathurst Street, have awarded a contract for refrigerating machinery, and for new buildings. This will be the first ice plant in the city, and will have a capacity of 100 tons daily.

Regina, Sask.—An abattoir with a meat packing plant and cold storage warehouse is planned by the Provincial Government. It is said that $1,000,000 will be spent at a central point, and a commission will be appointed to investigate the live stock industry in this province.

Calgary, Alta.—P. Burns & Co., Ltd., packers, exporters, etc., have rebuilt their plant, which was burned. They have installed a 250-ton refrigerating machine, with twin compressor, 17½ inches diameter ,and 42-inch stroke, and twin high pressure Corliss engines, 24 in. diameter, and 42 in. stroke. This, together with high pressure side and atmospheric condenser, was furnished by

the Ice and Cold Machine Co., St. Louis, Mo.

The Triumph Ice Machine Co., Cincinnati, Ohio, have supplied the following refrigerating machinery in Canada: John Casorso, Kelowna, B.C., 10½-ton complete ice making and refrigerating plant; Montreal Abattoirs Co., Ltd., Montreal, Que., 125-ton refrigerating plant, with Corliss engine drive; C. R. Harris & Son, Ltd., dairymen, Toronto, Ont., complete 12-ton refrigerating plant, to be used in cooling milk, etc.; P. Burns Co., Victoria, B.C., 2-ton refrigerating machine for their branch depot at tha' plant. This large meat packing concern now have in operation six Triumph plants in various parts of British Columbia. Ice Manufacturing Co., Ltd., Montreal, Que., complete 70-ton ice making plant, electrically driven, with multiple effect evaporators for supplying required amount of distilled water; Ottawa Artificial Ice Co., Ltd., Ottawa, Ont., 50-ton ice making plant, electrically driven throughout, multiple effect evaporators being utilized to produce the necessary distilled water for the ice cans.

Municipal

Vegreville, Sask. — When the town has sold $56,000 worth of debentures, it will proceed to drill more gas wells.

Walkerville, Ont.—The burgesses voted on Sept. 6 on a by-law to raise $16,-234 for cost of an incinerator plant.

Innisfail, Alta.—The by-law to raise by way of debentures $6,000 for the purpose of establishing an electric light plant has been voted on.

Trade Gossip

The Elmira Machinery & Transmission Co., has recently changed its management.

The Millers' Supply Co., 321 King Street W., Toronto, who recently started in business, are carrying the beltings of Fleming, Birkby, & Goodall, Ltd., Halifax, England.

John Coates, a British gas expert employed by the city of Ottawa to report on the best way of establishing a municipal gas plant, is expected shortly to make known his findings.

Dominion Coal Co. Output.—The output of the Dominion Coal Co. for August amounted to 425,635 tons, as compared with 409,125 tons for the same period in 1912. The highest previous output was in October last, when 422,842 tons were mined.

The Frick Company, Waynesboro, Pa., have recently installed refrigerating machinery at the following places: Chilliwack, Chilliwack Creamery Co., 20 tons; Montreal, Canadian Explosives, Ltd., 30 tons; Victoria, B. Wilson Company, Ltd., 57 tons.

The Canadian Fairbanks Morse Co., Ltd., expect to occupy their new Vancouver warehouse about the middle of September. The Montreal building on St. Antoine Street, a reinforced concrete structure now going up, has reached the fifth floor.

John M. Moore, late waterworks engineer, of London, Ont., has been officially appointed the appraiser of the waterworks plant for the investigation now being conducted at London into the operation of the system by a special joint committee of water commissioners and aldermen.

The Lancashire Dynamo & Motor Co., of Canada, advise us that they have taken possession of their new premises at 107-109 Duke Street, Toronto, where they have greatly increased facilities for carrying a much larger stock than hitherto, thereby eliminating all possible delays in future shipments.

Frank Pullen, president of the Kilmer, Pullen & Burnham Co., electrical engineers, Toronto, Ont., is taking a trip to Europe in order to find out the latest wrinkles in connection with the work of the Swedish General Electric Co., and to secure details in connection with large orders which the firm has recently secured.

The Smart-Turner Machine Co., Hamilton, Ont., report having recently received the following orders: The Canadian Porcelain Co., Hamilton, one automatic feed pump and receiver; E. D. Smith & Son, Winona, Ont., one Duplex pump; Corporation of St. Catharines, Ont., one Duplex pump; National Steel Car Co., one Duplex pump; The Donnacona Paper Co., Donnaconna, Que., one Duplex pump; Canadian Steel Foundries, Welland, Ont., one centrifugal pump; Garden City Paper Mills Co., St. Catharines, Ont., centrifugal pump.

The Hare Engineering Co., Toronto, Ont., has purchased the designs, patterns, and patent rights of the Aiton Machine Co., New York City, manufacturers of wire cabling, stranding, insulating, armouring, braiding, spooling, winding, and measuring machines, etc.; also, the complete line of rubber-working machinery, including mixers, grinders, washers, calenders, vulcanisers, vacuum dryers, hydraulic and button presses. The Hare Engineering Co. have secured orders valued at $20,000 since taking over this plant. Among others, they have secured an order for a seven-reel stranding machine for the Canadian Wire & Cable Co., Ltd., Dundas Street, Toronto. Raymond Lewine, late of the Aiton Machine Co., will be manager of this end of the business. Offices will be maintained in Toronto and Buffalo, N.Y., and arrangements are being made for the manufacture of the foregoing lines, both in Canada and the United States.

Contracts Awarded

St. Thomas, Ont.—A contract has been awarded by the Michigan Central Railway to the Goldie & McCulloch Co., Galt, Ont., for four 250h.p. water tube boilers.

Montreal, Que.—The contract for constructing underground conduits along Bleury Street and St. Catharines Street, between Guy and Atwater, have been awarded to G. H. Guest, the lowest tenderer.

Regina, Sask.—The new 1,500 k.w. unit, for the power house, ordered from Quilfor the power house, ordered from Willans & Robinson, Rugby, Eng., has arrived. The boilers, which have also arrived, were purchased from the Babcock-Wilcox Company. Each boiler has a capacity of 500 horse-power and a pressure of 200 pounds.

Hamilton, Ont.—The Hydro-Electric Board this morning awarded to G. M. Guest, Montreal, the contract for the underground construction of the civic power plant. The price was $177,822, and does not include the wiring. The cost to the city will be about $80,000, and the rest of the $177,822 will be borne by the Cataract Power and telegraph companies.

Personal

W. R. Perrin, architect, Toronto, has been engaged by the city of Ottawa to give his opinion on an abattoir for the Capital.

J. A. Calder, superintendent of the Glace Bay., N.S., electric department, has tendered his resignation effective September 30th.

Stanley Eisenhoffer, of the Toronto Hydro-Electric office staff, has been appointed superintendent of the underground wiring system of the Hydro-Electric at Hamilton.

Raymond Lewine, for fifteen years associated with the Aiton Machine Co., of New York City, has accepted a position as manager of the wire and rubber ma-

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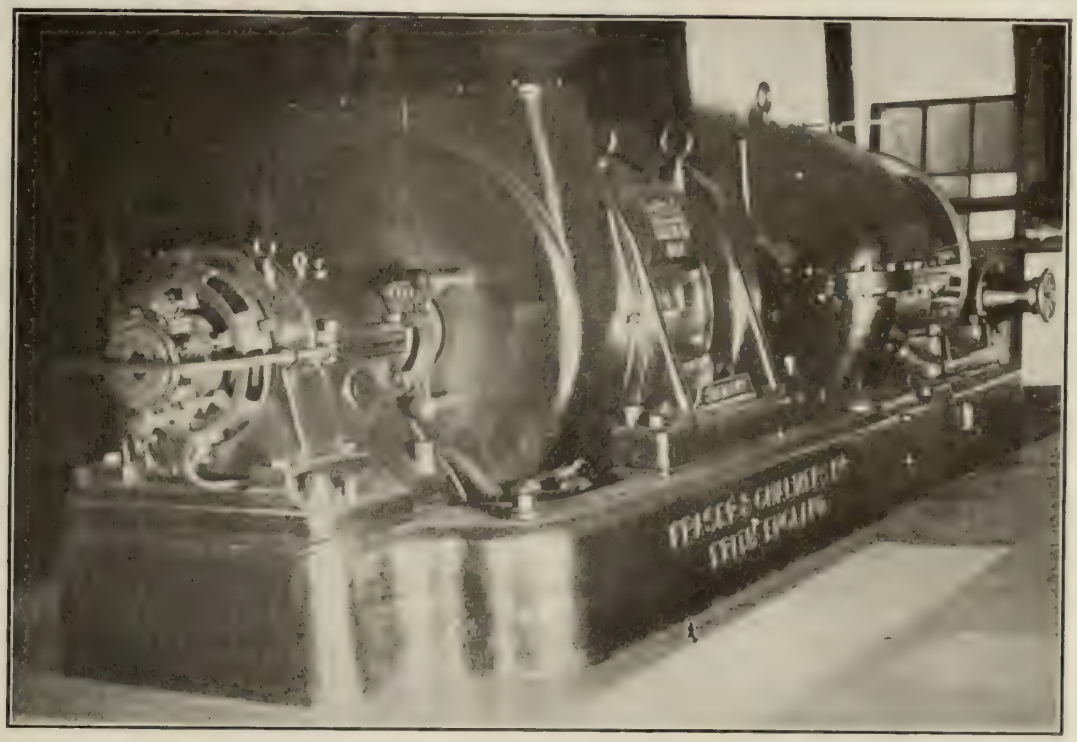

Siemens 750 K.W., 3600 R.P.M. Turbo Generator supplied to the Nova Scotia Steel & Coal Company Nova Scotia.

The following Siemens Turbo Generators have been supplied or on order for Canada:

1—4,000 K.W. Edmonton.
1—2,500 K.W. Dominion Coal Company.
3—2,000 K.W. Dawson City.
1—2,000 K.W. Edmonton.
2—1,500 K.W. Regina.
1—1,500 K.W. Lethbridge.
1—1,500 K.W. Moose Jaw.
1— 750 K.W. Nova Scotia Steel and Coal Co.
2— 750 K.W. Medicine Hat.
2— 500 K.W. Nova Scotia Steel and Coal Co.
1— 500 K.W. Wayagamack Pulp and Paper Co.

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chine department of the Hare Engineering Co., of Toronto, who have purchased the designs, patterns, and patent rights of the above company.

R. A. Ross, Montreal, who was engaged by the city of Toronto to value the electric light franchise and assets of the Toronto Electric Light Co. and Toronto Street Railway Co., has been asked by Mayor Hocken to hurry his report, as the matter must be submitted to the ratepayers before January 1.

W. A. Martin, formerly general manager of the Toronto Electric Light Co., with which he was connected for 23 years, and recently managing director of the Canadian British Engineering Co., Toronto street, Toronto, has taken over the Ontario end of the latter business, and will open premises at 70 Lombard St., Toronto, with a stock of tool steel, belting, etc.

A. A. Dion, of the Ottawa Electric Company, was elected president of the Canadian Gas Association at their annual meeting, held in Toronto last week. Their officers are: First Vice-President, Howard Mann, Montreal; Second Vice-President, R. A. Wallace, Quebec; Executive Committee, J. S. Norris, Montreal; J. M. H. Young, London; J. P. Kay, Stratford; Arthur Hewitt, Toronto; Secretary, John Keillor, Hamilton.

F. L. Fellowes, City Engineer of Vancouver, receiving a salary of $8,000 a year, the highest figure paid by any city in Canada, has been given six months' notice to terminate his agreement. He went to Vancouver from Westmount three years ago. The resignation was asked as a result of water pipes approved by his eastern representative being found below the standard, causing the city a loss of several thousand dollars.

R. N. Austin has been appointed manager of the Toronto office of Turbine Equipment Co., Ltd., engineers of 30 Church Street, New York. Mr. Austin was for six years with the Canada Foundry Co.—two years at the Davenport works, and the last four in the capacity of sales engineer for the Ontario district office, during which period most of his work was in connection with turbine pumps. The above company is the special selling agent for the De Laval Steam Turbine Co., Trenton, N.J.

Catalogues

Orenstein-Arthur Koppel Co., Pittsburg, have sent us catalogue No. 412 describing their cast plate track and charging cars for power plant boiler rooms, hotels, office buildings, etc. The Canadian sales agents for this company are the Canadian Fairbanks-Morse Co., Ltd.

The Canadian Steam Boiler Equipment Co., Toronto, has issued a pamphlet dealing with the "cyclone shaking and dumping grate bar" which they manufacture. The apparatus is fully described and illustrated, the principal features being clearly explained. The pamphlet also contains some testimonials and a list of users. Copies may be had on request.

The Canadian Consolidated Rubber Co., Ltd., Montreal, have forwarded a copy of their catalogue "A," which deals with the company's lines of belting for power transmission and conveyor purposes; steam, air and fire hose; sheet packing; ring packing, etc., etc. The catalogue is well gotten up, and contains numerous useful tables and rules for belt lacing.

The Canadian Allis-Chalmers, Ltd., have issued a bulletin describing the "Squires" steam trap for which they are the selling agents. Sectional views are given showing the patent double valve mechanism together with a complete description covering the design and method of operation. Tables giving the capacity of each size are included. Copies of the bulletin will be gladly mailed on request.

Canadian Allis-Chalmers, Ltd., Toronto, have sent us a copy of bulletin No. 89, describing the "Foos" gas engine for which they are the selling agents for Canada. Full particulars are given regarding the various purposes for which this engine can be employed, also of the various fuels that can be used to operate it. Some interesting tables are given covering capacities of pumps working in conjunction with "Foos" engines. The bulletin is fully illustrated, and copies may be had by writing.

Book Reviews

The Dept. of Commerce and Labor of the U.S. Government, has issued a publication entitled the "Foreign Commerce and Navigation of the United States" for the year ending June 30, 1912. This is a bulky volume published annually and contains 1,342 pages of statistics and matter covering the imports and exports of the United States, fully classified and indexed.

The Commission of Conservation appointed by the Canadian Government, have issued a report of the fourth annual meeting held at Ottawa. The publication contains reports of the various committees appointed under the Commission giving the results of their investigations, also much valuable and interesting information regarding the natural resources of the Dominion. The report contains a number of excellent photographs and some maps.

The Department of Mines of the Dominion Government has published a monograph on the nickel industry which will be specially interesting owing to the fact that the International Geological Congress has recently been held in Toronto. The monograph is the result of investigations conducted by G. P. Coleman Ph.D., director of the Geological Department, Toronto University, in the Sudbury nickel region, on behalf of the Canadian Government. A complete description is given of the Canadian Copper Co.'s plant and property at Copper Cliff, Ont., and other plants in that district together with many interesting photographs and maps. Much valuable information is given of the nickel industry both from a geological and mechanical standpoint. The publication also contains descriptions of well-known plants in other parts of the world.

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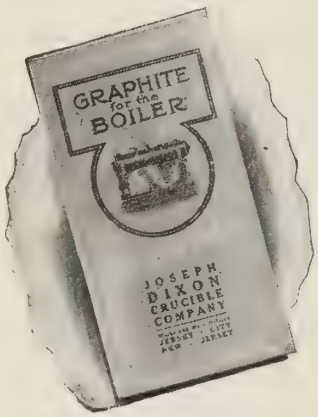

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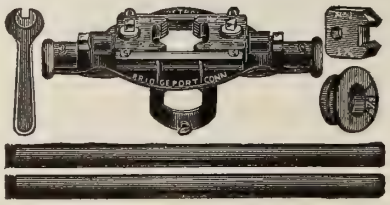

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Those who wish to sell or buy a business, obtain competent help, connect with satisfactory positions or secure aid in starting new enterprises, should not fail to use the Want Ad. Page of The Power House.

Do you want to sell or buy a second hand engine or any other equipment? Let The Power House pick out a seller or buyer for you.

There is always some one looking for just such proposition as you have to offer.

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AGENTS WANTED

LIBERAL COMMISSIONS TO DEALERS AND others handling Vulcan Soot Cleaners; applied to all types of boilers. Vulcan Tube Cleaning Systems, Limited, 42 Craig St. West, Montreal. (tf)

WANTED — EVERY POWER HOUSE IN Canada to remember that C. E. Shedrick, Craig Street West, Montreal, is still repairing measuring instruments, both switchboard and portable. Twenty-five years' experience in repairing all kinds and makes on the market. Integrating meters repaired, tested and sealed, and returned on quick time. (tf)

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BELTING FOR SALE — 800,000 FEET OF best quality leather, rubber, hair and canvas belting, bought from bankrupt manufacturers at 25% to 75% less than the regular value. Also a large quantity of slightly used belting, piping, chains, rails, pulleys, hangers, cotton waste, etc., at very low prices. Send for catalogue. Imperial Belting & Supply Co., 5 Queen Street, Montreal. (tf)

FOR SALE—A 90 H.P. BRUCE MACBETH gas engine, complete with 75 K.V.A. dynamo, switchboard and exciter. All in first-class condition; in use less than four months; a bargain. The Winkley Company, Detroit, Mich. (10)

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PRACTICAL COURSES BY MAIL IN STATIONARY Engineering, Traction, Marine, Gasoline, Automobile, Locomotive, Electric Lighting and Power. Write, stating in what you are interested. Canadian Correspondence College, Limited, Dept. P.H., Toronto, Canada. (8)

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¶ An idea that's worth anything at all to a Power Plant man is worth more than two cents.

¶ It might be worth hundreds of dollars.

¶ Every issue of "THE POWER HOUSE" is full of practical, helpful ideas. You ought to be able to sift out four each month that would prove of some use to you. Put a value of two cents on each and your subscription has been paid.

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¶ The date on the label of your "POWER HOUSE" wrapper shows when your subscription expires. One dollar will renew it for a year.

Don't put off Renewing—Do it to-day
Neglect blew up the Boiler

PRACTICAL HANDBOOKS FOR HOME STUDY

STEAM BOILERS. By William S. Newell, S. B., with Bath Iron Works. Formerly Instructor, Massachusetts Institute of Technology, and Carl S. Dow, S. B., American Society Mechanical Engineers. 160 pp., 124 illus. Cloth binding. A practical treatise on the materials and approved methods of construction of steam boilers, with complete instruction in the mechanical details of the various commercial types of stationary boilers, such as the vertical, horizontal, water-tube, fire-tube, etc. Price $1.00

STEAM ENGINES. By L. V. Ludy, Acting Professor of Steam and Gas Engineering, University of Wisconsin, American Society of Mechanical Engineers. 165 pp., 75 illus. Cloth binding. A concise, practical manual for the use of Engineers, Firemen, Machinists, Oilers, and Shopmen in general. The principles of operation; types of engines fitted for different kinds of work; types of simple and multiple-expansion engines, engine accessories—all are clearly explained in a way that anyone can grasp. Price $1.00

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THE MACLEAN PUBLISHING COMPANY, LIMITED
143-149 University Ave., Toronto

INCREASES

Boiler Capacity and Efficiency

AND SAVES FUEL

Walker's Electric Boiler Compound is not only a remover and preventative of scale—it is an effective remedy for all boiler troubles, such as pitting, corrosion, etc., due to impurities in the feedwater.

We use nothing in the preparation of this compound that is injurious to tubes, fittings or pumps. **Try a barrel.**

Send us a sample of your feed water for analysis and get our prices.

Our line of high-grade Lubricating Oils, Greases, Packings and Engine Supplies meet the complete approval of all engineers who have tried them.

The Electric Boiler Compound

COMPANY, LIMITED

Guelph, Ontario

SPECIAL WORKS FOR STEAM TRAPS

Established 1878 Exportation

Speciality:

SCREW-VALVE STEAM TRAPS.

RETURN STEAM TRAPS

for Feeding Back Hot Condensed Water direct to Boiler,

— Without Pump. —

EQUILIBRATED FLOAT-VALVES.

AUTOMATIC WATER ESCAPE VALVE

for Draining the Cylinders of Steam Engines.

GRAPHITE OIL LUBRICATING PRESS

About 70% of Oil saved!

DUPLEX-DRAFT INDICATOR

for Boiler - Furnace.

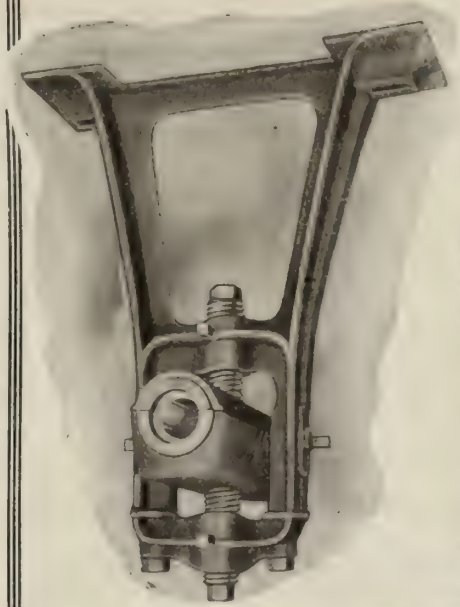
ELMIRA

Ball & Socket HANGERS

For MAXIMUM Service

Wood Split PULLEY

AND BIG REDUCTION IN POWER TRANSMISSION COST



The "Elmira" Ball and Socket Hanger

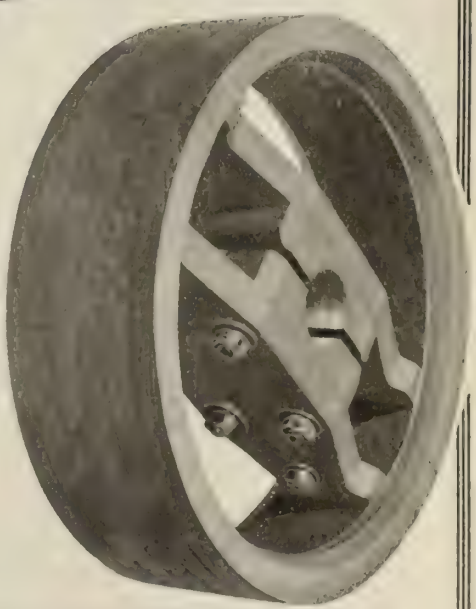
is exceptionally strong and heavy. In this hanger a union system of oiling is employed, a combination of centrifugal and capillary attraction, effected by tempered steel rings and woven cotton distribution of lubricant, and precludes the slightest possibility of "Dry Bearings" so long as any oil remains in the reservoir or dry chamber, one filling of which should last from **six to twelve months.**

The "Elmira" Wood Split Pulley

You can use an "Elmira" Pulley any place that a leather belt will give satisfaction, and know that what any good pulley will do, it will do, and more.

This pulley **stands the hardest and most severe conditions.** It is nailed throughout. The arms are tenoned into rim and dowelled there.

Absolutely guaranteed.



It will be much to your interest to let us furnish you with our illustrated catalog. Write for it to-day.

Large and complete stocks carried at Elmira and by The A. M. Ellicott Co., 301 St. James Street, Montreal, Que., Sole Eastern Agents.

Elmira Machinery & Transmission Co., Ltd.

ELMIRA, CANADA

The advertiser would like to know where you saw his advertisement—tell him.

HINTS TO BUYERS

Mueller Pressure Reducing and Regulating Valves

Give accurate and absolute control of pressures of water, steam, air, gas, oil, carbonic and acetylene gases—in fact, all kinds of pressures. Their efficiency is firmly established. Manufactured under Canadian patent No. 127,566. Address:

H. Mueller Mfg. Company, Ltd.
Sarnia - Ontario

LUBRICATING OILS

Canadian Oil Companies, Limited

TORONTO MONTREAL ST. JOHN
HALIFAX WINNIPEG
REGINA CALGARY
NELSON

Scandinavia Belting

SCANDINAVIA BELTING

is more durable than the best of leather, runs steadier and truer, transmitting the power without vibration. Its tensile strength is much greater than that of leather, rubber, and stitched canvas, and is less liable to break under a sudden strain.

Write for new Book, The Main Drive.

Federal Engineering Co., Ltd.
Toronto Montreal

Don't Use Boiler Compounds

Which are always injurious to boilers and valves.

We guarantee an absolute Metal Clean Boiler, when there is sufficient exhaust steam. Get the Nobis habit around your power plant.

Best References

The Nobis Engineering Co.

GUSTAV NOBIS
Rheydt, Germany
ENGINEER, MANUFACTURER AND HEATING CONTRACTOR
Founded 1880

Heating Engineers and Contractors
329 King St. West, Toronto
Phone Adelaide 3669.

Notice to Stationary Engineers

Everyone operating a Stationary Steam Plant of 50 h.p. or over, in the Province of Ontario, must hold a Certificate from this Board. Anyone operating such a plant without a Certificate is liable to the penalties set forth in the Stationary Engineers' Act

HON. J. S. DUFF,
Minister of Agriculture.

W. C. McGHIE,
Chairman of Board,
Parliament Buildings, Toronto

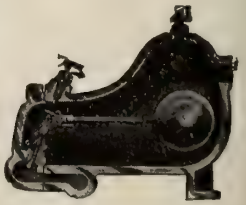
McDANIEL IMPROVED STEAM TRAP

FOR HIGH OR LOW PRESSURE.

Steam can't blow through. They have large discharge valves and cannot be flooded from sudden flushes of water.

MAY WE SEND ONE FOR TRIAL?

Reducing Valves, Pump Governors, Relief Valves, Exhaust Pipe Heads, Ejectors and Steam Separators. SEND FOR CATALOGUE.



THE GARTH COMPANY
26 Craig St. MONTREAL, CAN.

WATSON & McDANIEL CO.,
No. 146 N. 7th St. PHILADELPHIA, Pa.

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WHY USE OIL

When GREASE Gives More Uniform Lubrication, Is Better and Much Cheaper?

This Grease Cup will pay for itself many times over with the money it saves in lubricants.

You know that Oil cannot be properly controlled—much of it is lost through dripping.

Grease when used in this Grease Cup is under perfect control until the last drop is used.

The efficiency of this Grease Cup cannot be affected by centrifugal force when used on loose pulleys.

REMEMBER we guarantee it to save 50% over any other system.

Give it a trial and be convinced.

Write for particulars.

Peterborough Machine and Lubricator Co., Limited

Peterborough, Ontario

Toronto Engineers Should Join The

Canadian Association Stationary Engineers

Toronto No. 1

Meets on the 2nd and 4th Wednesdays in Foresters' Hall, 22 College Street.

Any engineer who wishes to join will be welcomed.

On the 4th Wednesday, from October to April, the meetings are open to all, and lectures are to be given by competent men on all subjects pertaining to engineering.

EMPLOYERS

who wish to secure competent men are invited to write the Secretary, who will be pleased, at all times, to get them good men.

JOHN W. MARR, Secretary
78 Duke Street

JOHN C. TWEEDALE, Pres. **C. MOSLEY, Treas.**

Machine Banded Wood Stave

WATERPIPES and TANKS

For city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited

P.O. Box 563 **Vancouver, B.C**

WRITE FOR CATALOGUE

Full Particulars and Estimates Furnished

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS

TO THE STATIONARY ENGINEER WHO IS NOT A MEMBER OF THE C. A. S. E.

Have you ever seriously considered the necessity of mingling freely with your fellow-men whose life's occupation is the same as your own? If you have not, I would like to place before you the advantages which accrue to all thus associated.

We preach the doctrine of elevation of the Engineers through the medium of education.

By joining one of the subordinate associations of the C.A.S.E. you can gain knowledge of the character which is deemed so essential by successful practitioners of all the useful professions.

In all fairness I would ask you if an organization devoted to the calling at which you earn your daily bread is not entitled to special consideration from you?

For further particulars write

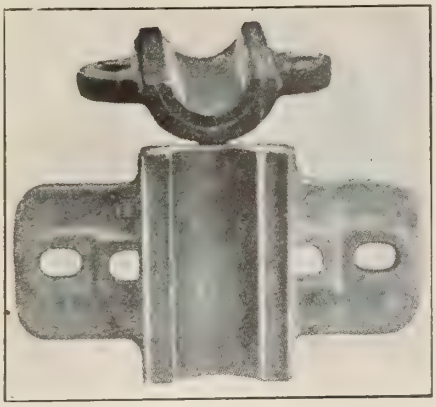
A. KASTELLA
Executive Secretary

STRATFORD, - - - ONTARIO

The advertiser would like to know ***where you saw his advertisement—tell him.***

GRAPHITOL

Pat. and Trade Mark Registered.



New Anti-friction Material Bearing.

Graphite is nature's greatest lubricant.

Pure graphite hardened in the **Graphitol** way makes the most frictionless machinery bearings possible.

Graphitol has recently been improved to such a degree of excellence that it is becoming of unquestioned value for many purposes.

Graphitol is shipped in powder form, mixed with a prepared liquid when required, and applied in paste form, when it hardens durably.

Graphitol bearings mean reduced initial cost, greater efficiency, less oil, and cool running.

Write for free illustrated pamphlet, to

BRITISH PACIFIC SUPPLY CO.
F. C. Winkler, Manager
VICTORIA, B.C.

COAL

The freight and duty is the same on **high grade coal** as on medium or low grade coal.

Our **Lone Star** small coal is **guaranteed** to show 14,000 B.T.U.'s regularly.

Our specialty in Canada is high grade coal from Kentucky and West Virginia via Detroit.

Let us have your inquiries, and call on us if in need of **prompt shipment,** via Buffalo, Car Ferry or Detroit.

Ohio & Michigan Coal Co.

Mines in Ohio, West Virginia and Kentucky

Main Office
82-83-84 Home Bank Bldg., DETROIT, MICH.

Second Hand
BOILERS

We have a few exceptionally good Second-Hand Horizontal Tubular Boilers in stock which we are offering at very attractive prices.

Some of them are practically new and all of them are in good order, and if you want a second-hand boiler, this is a particularly good opportunity for you.

Shall we send you particulars?

William Hamilton Co.
PETERBOROUGH, ONT.

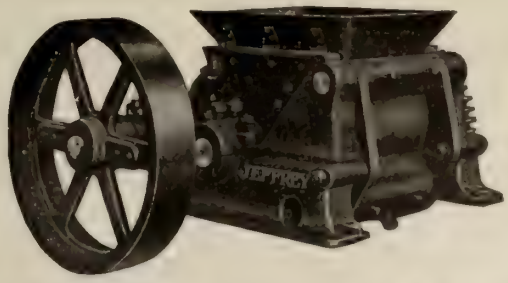
THE
CANADIAN CASUALTY
AND
BOILER INSURANCE COMPANY

This Company makes a specialty of inspecting boilers under construction, and issues an official Certificate of Inspection, as required by the Laws of Ontario which came into force on the 1st July.

CONTINENTAL LIFE BUILDING
TORONTO

J. O. B. Latour, Chief Engineer.
John J. Durance, Manager.

Phone Main 6941



Saving of Power is Money

The Jeffrey Single Roll Crusher

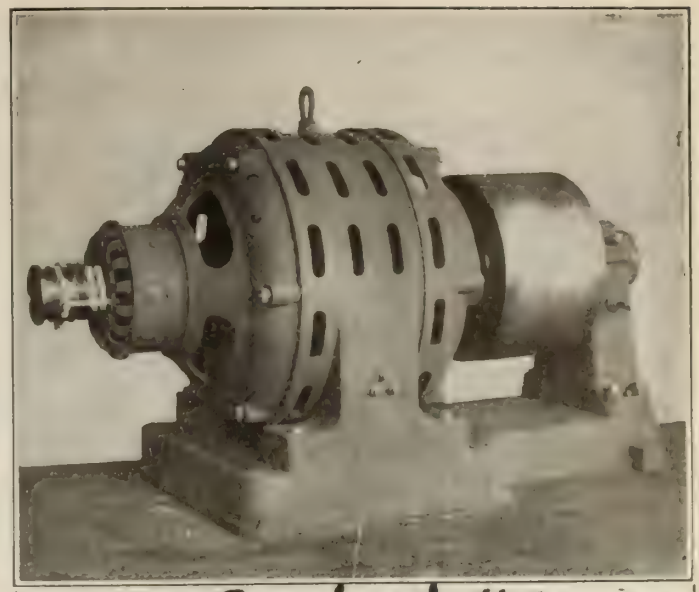
will crush more coal with less power than any other machine on the market.

Reduces Coal to stoker or any desired size, in a single operation.

Receives coal in any volume direct from a track hopper, grab bucket, or mine car without requiring a feeder.

If you are interested in securing a constant supply of small Coal, write for our Bulletin No. 41-A, giving full particulars.

JEFFREY MANUFACTURING COMPANY
Canadian Main Office and Works, MONTREAL
Winnipeg Representatives, N. J. DINNEN & CO.



A.C. Generator with Three Bearings

POWER PLANTS, ROLLING MILLS, MINING, HOISTING MACHINERY
ELEVATORS PATENT "STIGLER"
Builders under patents of "STE. ALSACIENNE"
Belfort (France) Mulhouse, Graffenstaden (Germany)

Engineering Works of Canada
Head Office: 805-7 New Birks Bldg.
MONTREAL, Quebec

H-P=PLAN/33,000

You can compute P from your indicator card, you know L and can figure A, but how do you find N? The surest way, on a high speed or a slow speed engine, is to use a

Starrett Speed Indicator

It registers any speed without heating of parts. Equally good for motors, gas engines, line shafting or any revolving machine-part. Rubber tips for centered or pointed shafts. For sale at all hardware stores.

Get the Starrett Catalog No. 20 C.D. It shows other tools for the engineer.

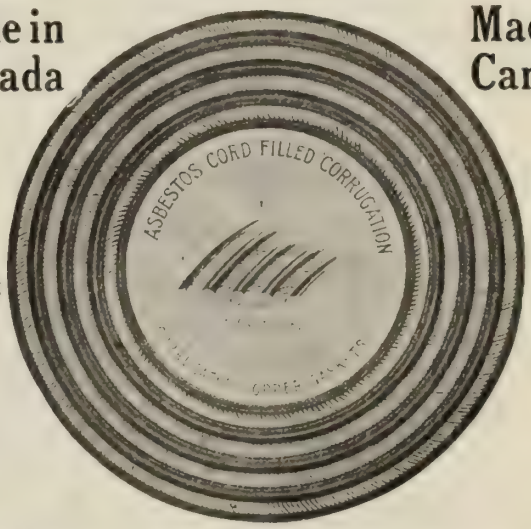
The L. S. Starrett Co.

Athol, Mass.

NEW YORK 150 Chambers Street LONDON 36 & 37 Upper Thames Street, E.C. CHICAGO 17 No. Jefferson Street

42-69

Made in Canada **Made in Canada**



Cheapest Gasket in Canada

Net prices for above Gaskets are as follows:—

2 in.	Std 17c. Ex Hy 20c.	6 in.	Std 50c. Ex Hy 56c.
2½ in.	Std 21c. Ex Hy 24c.	7 in.	Std 58c. Ex Hy 65c.
3 in.	Std 25c. Ex Hy 28c.	8 in.	Std 67c. Ex Hy 74c.
4 in.	Std 34c. Ex Hy 37c.	10 in.	Std 85c. Ex Hy 93c.
5 in.	Std 43c. Ex Hy 47c.	12 in.	Std 99c. Ex Hy $1.10

Absolutely the best and cheapest Gaskets on the Market to-day.

WRITE FOR SAMPLES

Canadian Gasket Co., Bridgeburg, Ont.

Manufacturers of all kinds of Metal Gaskets

The advertiser would like to know where you saw his advertisement—tell him.

Morehead Back-to-Boiler SYSTEM

Delivers Every Ounce of the Condensation in Steam Lines Back to the Boiler With Practically no drop in Temperature.

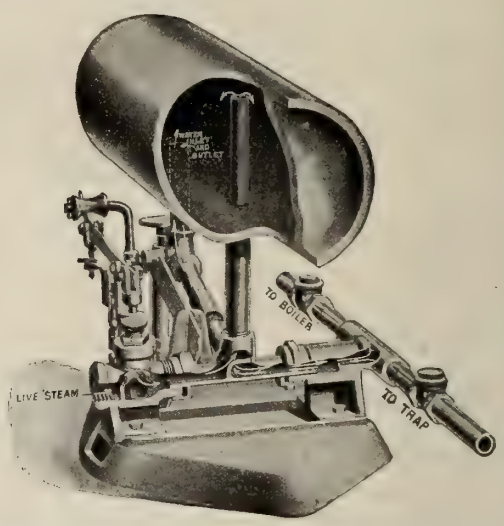
For twenty-two years it has been producing results that are unequalled by any other trapping system.

There is no simplex trap made. It works by gravity — one of nature's forces that never gets out of order.

Morehead Traps are being used everywhere on heating, drying and cooking propositions of every kind from straight pipe work to fan stacks, and under vacuum conditions without regard to the difference in pressure between the apparatus drained and that carried on the boiler, and without regard to the location of the apparatus drained, whether above or below the water line in the boiler.

Morehead Traps save much in fuel bills, repair expenses, etc.

It will be to your interest to send for a trial trap. You can return it at our expense if not as we claim.

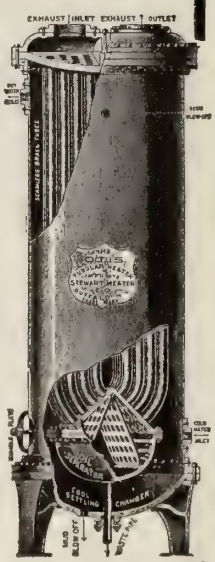


The Canadian Morehead Mfg. Co., Ltd.,
Woodstock, Ont.

Save Fuel and Increase Profit

A few engineers find this a difficult problem. They are not acquainted with

The "OTIS"
TUBULAR FEED WATER HEATER, OIL SEPARATOR AND PURIFIER



The exhaust steam when harnessed and passed through this Heater will heat the Feed Water to a boiling point before it enters the boiler. This effects an enormous yearly saving in fuel.

Write for descriptive catalog and prices.

The STEWART HEATER CO.
189 Norfolk Ave., Buffalo, N.Y., U.S.A.

Get the Genuine

Over 1,250,000 Detroit Lubricators are in use to-day —giving daily satisfaction on every kind of machine. The reputation earned by these lubricators—some of which have been in service over a third of a century—has resulted in a host of imitations.

These imitations are not as good as the **genuine** Detroits. If they were, they would be sold on their own merits, and not on the basis of being as good as the "Detroit."

The appearance of Detroit Lubricators may be closely copied, but the experience of thirty-six years in the study of lubricators and lubrication, which lies behind every Detroit Lubricator — the long experience in designing and building — the magnificent manufacturing facilities of the largest makers of lubricators in the world — these things cannot be copied.

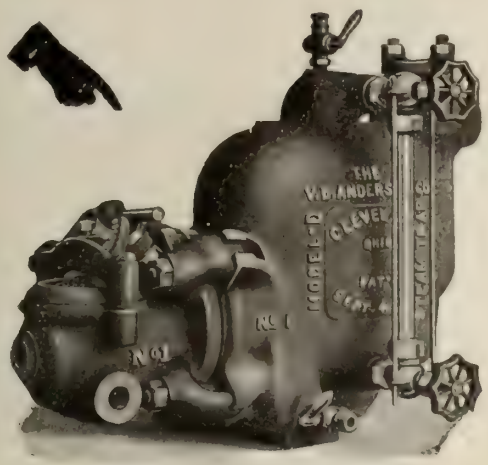
Genuine Detroit Lubricators embody in a perfectly balanced design all the essentials and refinements of a modern lubricator.

There is one particularly suited for any engine you may have.

CANADIAN DETROIT LUBRICATOR COMPANY, LTD.
WALKERVILLE, ONTARIO
Largest manufacturers of lubricating devices in the world.

The advertiser would like to know where you saw his advertisement—tell him.

An Efficient And Reliable Apparatus For Continuously Draining Condensed Water From Steam Coils, Jackets, Radiators, Etc.



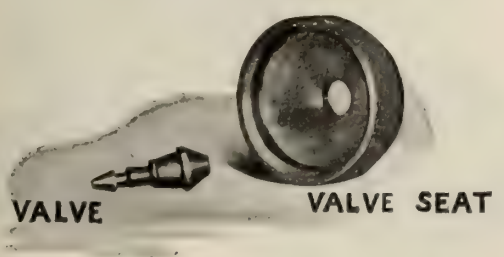
The ANDERSON MODEL "D" Steam Trap

The Anderson does its work without permitting the escape of live steam.

All parts are interchangeable, being machined to solid guages, thus insuring absolute accuracy.

Anderson Model "D" is a positive assurance of the elimination of the trouble that usually occurs with faulty heating systems.

Every trap is carefully tested and inspected under steam pressure before it leaves our factory.



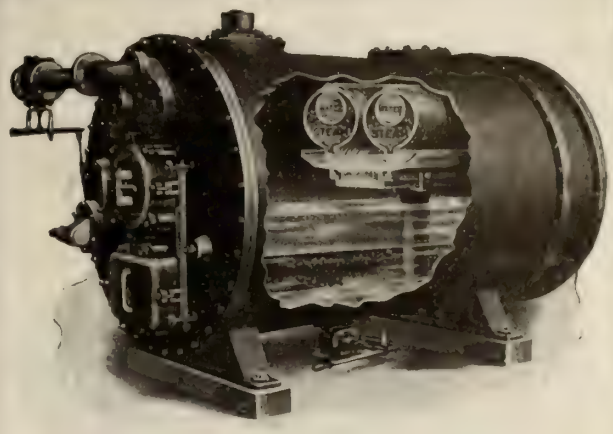
The trap is so constructed that you can change the valve and seat from high to low pressure, or vice versa, in five minutes without disturbing or unscrewing a single steam joint or pipe connection.

A removable perforated strainer is part of the equipment. This prevents pieces of scale, packing lead, etc., from entering the trap.

It will be to your interest to get our descriptive booklet. Mail your request for it to-day.

THE V. D. ANDERSON CO.
West 96th St., CLEVELAND, OHIO

BRANCH OFFICES: 330 Manhattan Building, Chicago, Ill.; 619 Park Bldg., Pittsburg, Pa.; 3 Arch St., Philadelphia, Pa.; 212 Walnut St., Cincinnati, Ohio; 207 Union Trust Building, Baltimore, Md.; 91 High Street, Boston, Mass.



PERFECT utilization of steam is economy—partial use is commendable — exhausting into the atmosphere is extravagance. Save the heat units by using a

NATIONAL

DIRECT CONTACT FEED WATER HEATER AND PURIFIER

It is the only feed water heater in which all of the steam and all of the water must come into direct and actual contact, thereby insuring the highest possible temperature.

It's a heater, purifier, filter, storage tank, oil separator—all in one. It heats by bringing the water and exhaust steam into actual contact. It has upward filtration, which insures longer life to the filter material, prevents filter material being carried over to the pump, and reduces the frequency of cleaning and replacing.

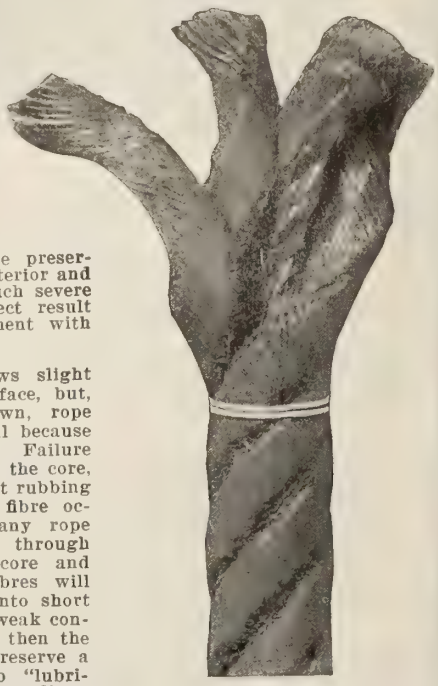
Ask For Catalog No. 2

The National Pipe Bending Co.
91 Lloyd Street
New Haven, Connecticut

Pipe Coils and Bends of Every Description Iron, Brass, Copper, etc.

46-45

Another Successful Record Made by Cling-Surface. This Time on a Rope Drive.



You wouldn't think that this short length of rope had transmitted power for five years, and out in the open, as shown below, where it was subjected to rain, sunshine, frost and the storms of the lake regions.

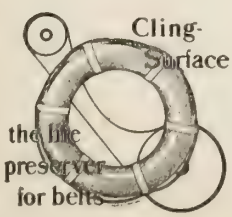
The remarkable preservation of both exterior and interior under such severe duty is the direct result of proper treatment with Cling-Surface.

The rope shows slight wear on the surface, but, as is well known, rope drives seldom fail because of surface wear. Failure usually begins at the core, where the severest rubbing of fibre against fibre occurs. Examine any rope that has failed through wear, and the core and other internal fibres will be found worn into short lengths, or very weak condition. Obviously then the proper way to preserve a rope drive is to "lubricate" these rubbing fibres and prevent them from grinding themselves thin and weak. Cling-Surface does this in the best way, because it does not make the rope or belt sticky, but penetrates and lubricates every tiny fibre, inside and out to the very center. Close contact and firm grip on the driving and driven pulleys are thus secured, power losses are minimized, the drive is waterproofed throughout (Cling-Surface will not wash off in the rain), and initial tensions may be reduced to such an extent that free, easy running becomes practical, as in this case.

Cling-Surface is used and recommended by the largest makers of rope.

Whether your drive is belt or rope, indoors or out, you **need** Cling-Surface. Give us a chance and we'll prove this to your complete satisfaction.

Send us a first order **now**, or at least ask for literature. Quotations are f.o.b. Toronto.



Cling-Surface Co

1057 Niagara Street
Buffalo N Y

62

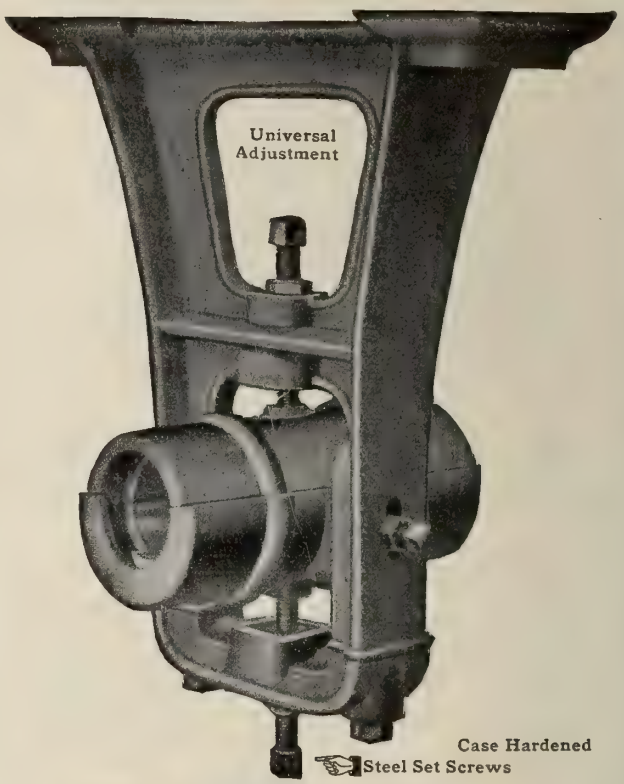
Hangers and Couplings

TRADE MARK BOND DOUBLE-SURE QUALITY PATENTED

of Merit

A trial will convince you that Bond Hangers and Couplings are by far the most economical.

They are built for exceptionally long service and they give it everywhere.



The "Bond" Patent Spiro Compression Coupling.

50% more gripping force than any other Compression Coupling

Drop us a line for full particulars. You have nothing to lose and much to gain.

Canadian Bond Hanger & Coupling Co., Ltd.

ALEXANDRIA, ONT.

THE TRIPLEX BLOCK

The Best Practice in Power Plants

THE new book of Hoists shows modern boiler room installation for handling coal by electric hoist and trolley. Under 4,000 lb. loads these hoists travel 350 feet per minute from bunkers to furnace, controlled from the floor or from a trailer cage.

Both for the Power Plant or Marine Engineer this book shows the latest application of chain blocks and trolleys to enable one man to lift, move and adjust any load up to 20,000 pounds.

Write for a copy of this book to-day. It will result in decreased costs in handling.

Safety of Steel

The Triplex Block is steel construction—steel in all load bearing parts, sheave, gears, pinion, hooks and chain.

EACH BLOCK TESTED TO 50 PER CENT. OVERLOAD

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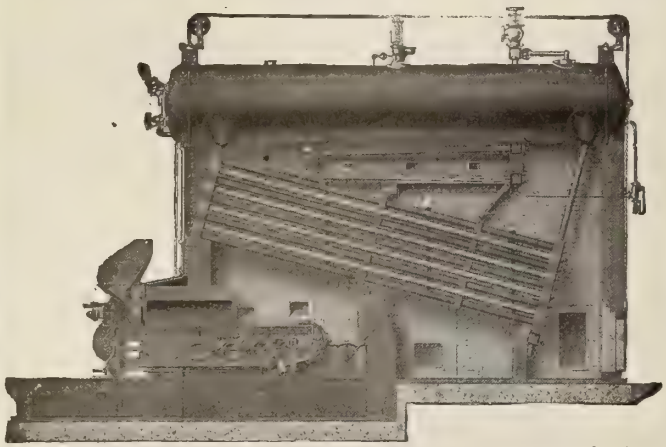

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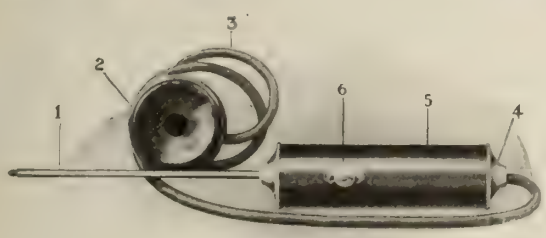

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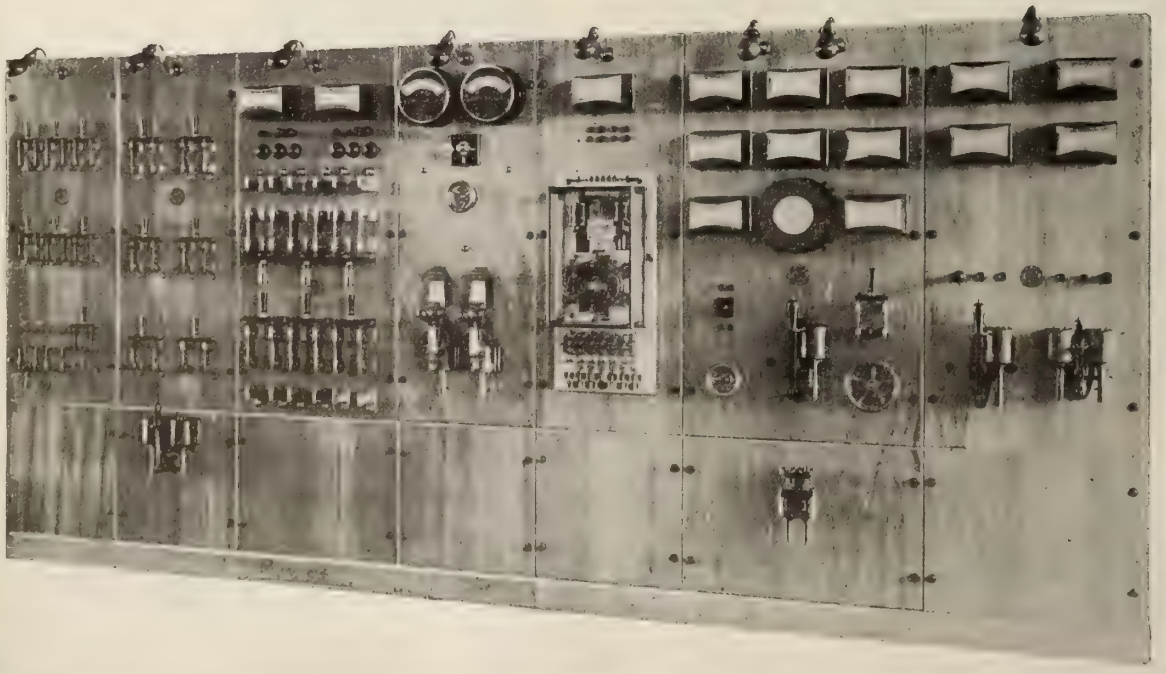
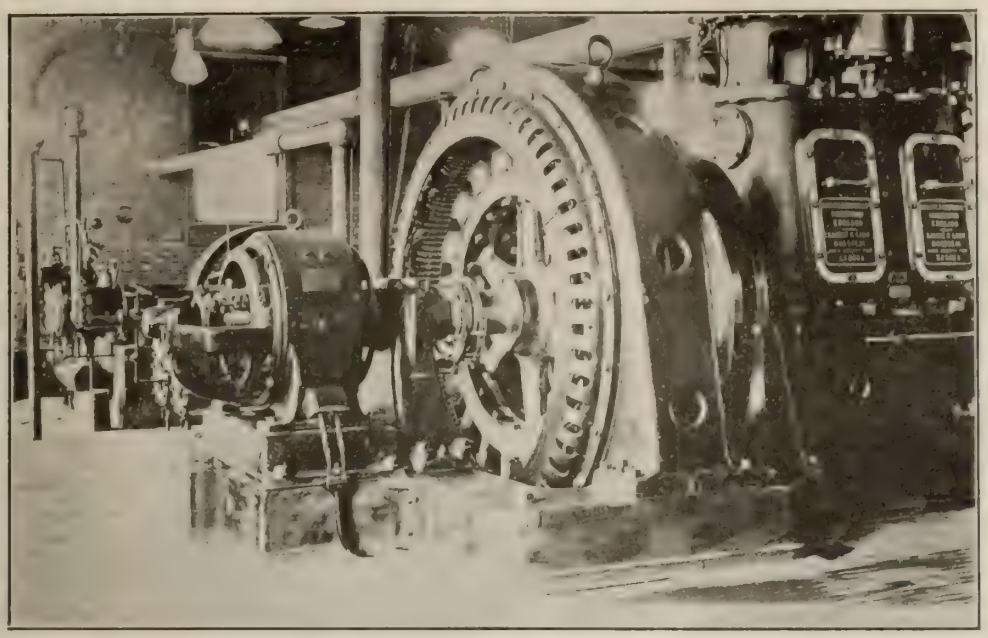
ST. LAMBERT, P.Q., District of Montreal



Switch Board Specialists

High Class Swedish Electrical Equipment



Owing to liberal design and the use of the best grade of Swedish Steel and Iron, we are able to guarantee and obtain the very best results.

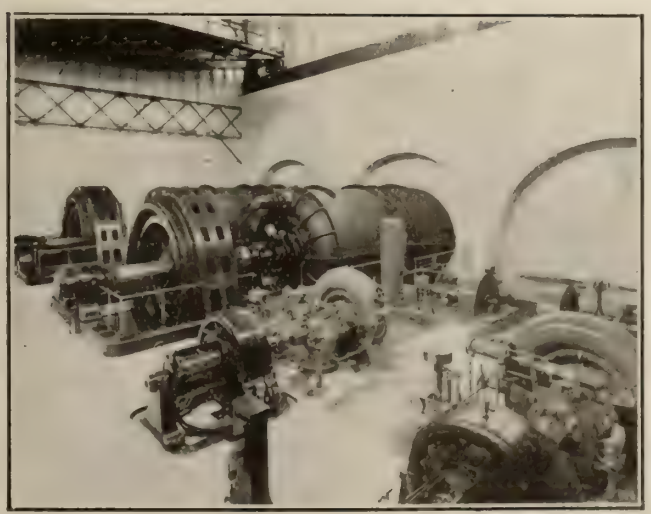
350 K.V.A. 2200 Volt, 2 Phase, 60 Cycle, 360 R.P.M., AC. Generator connected to Bellis & Morcom High Speed Engine, supplied to Corporation of Wetaskiwin, Alta.

KILMER, PULLEN & BURNHAM, Limited

Head Office : TORONTO **Branch Office : MONTREAL**

ESCHER-WYSS & CO.

ENGINEERS



52,000 H.P. Plant Western Canada Power Co.

HYDRAULIC
STEAM } **PLANTS**
PUMPING

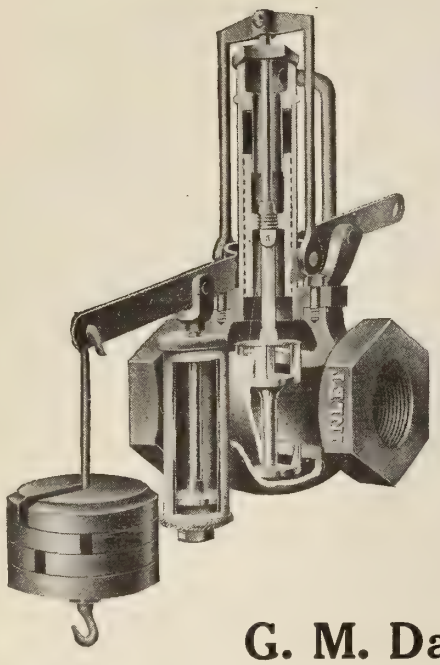
HEAD OFFICE FOR CANADA :

626 Coristine Bldg.,

MONTREAL, Que.

The advertiser would like to know where you saw his advertisement—tell him.

Make Every Pound Count



There is no need of your using 125 pounds pressure throughout your plant just because your boilers carry that pressure.

You can make a big saving in steam consumption and prevent wear and tear on your equipment by reducing the initial pressure down to the required pressure with a

Davis Pressure Regulator

A Safeguard Against The Needless Waste Of Steam

No matter what your boiler pressure may be or how much it may fluctuate, if you will use this automatic valve you can always get the most efficient economical pressure for your engine, pump, heater, cooking kettle, dry kiln, heating system or whatever local conditions may demand.

This simple, efficient device is saving money by saving steam in thousands of plants everywhere. It has no springs, toggles, packing, auxiliary valve or diaphragm. Its principle of operation is the balancing of pressure by direct weights which makes it positive in its action and easy to adjust for any working condition.

Let us make you a proposition on the reducing valves you need.

G. M. Davis Regulator Co. 434 Milwaukee Avenue CHICAGO

Established 1875

New York—123 Liberty Street
Pittsburgh—1st National Bank Building
Philadelphia—2528 No. American Street
St. Louis—735 S. Fourth Street
Boston—70 High Street
San Francisco—Rialto Building

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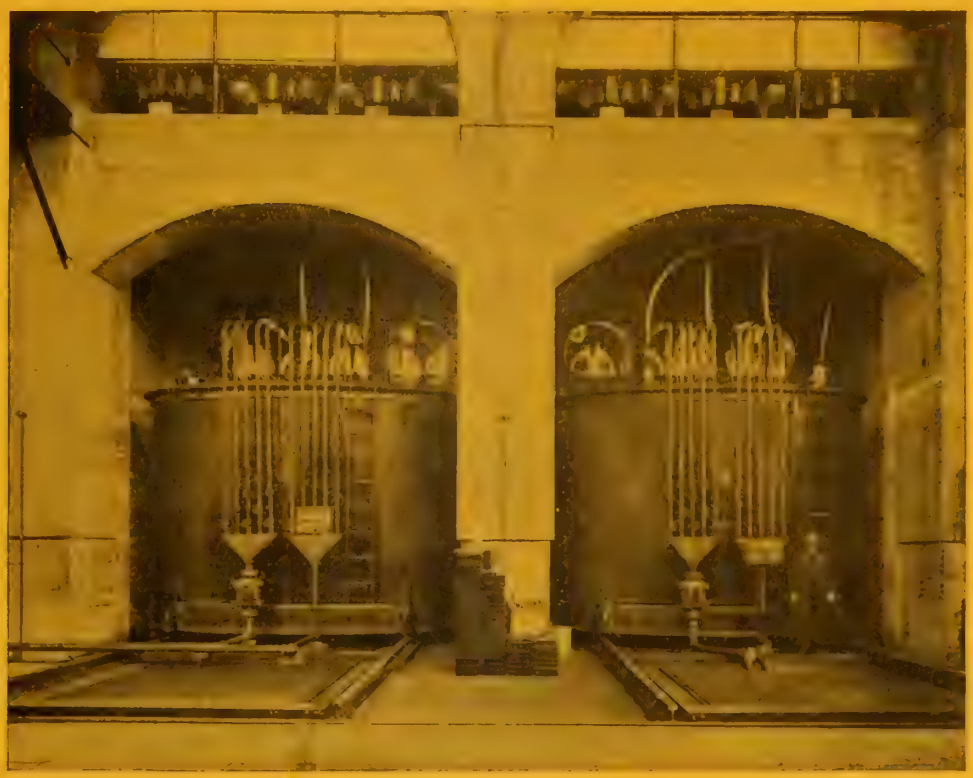
Westinghouse

Heavy-Capacity, Oil-Insulated Water-Cooled Transformers



An Installation of two 10,000 Kva. Westinghouse Oil-Insulated, Water-Cooled Transformers.

An Interesting Installation

SINCE the first Westinghouse Transformers were purchased, a total of eight of equal capacity have been installed in the power house and sub-station of the company whose apparatus is illustrated.

The record is perfect.—No trouble.—No breakdowns—When you buy Westinghouse Transformers, you get Quality.

Canadian Westinghouse Co., Ltd., Hamilton, Ontario

TORONTO Traders Bank Bldg. | MONTREAL 52 Victoria Square | OTTAWA Ahearn & Soper, Ltd. | HALIFAX Telephone Bldg. | WINNIPEG 158 Portage Ave. E

CALGARY 311 8th Ave. West | VANCOUVER Bank of Ottawa Bldg.

Engineers' Supplies, Brass Goods Pipe Fittings and Tools

Highest Quality Guaranteed

J. M. T.
Globe Valve.

Steam Whistle.

J. M. T.
Hose Gate Valve
with Cap and Chain.

TRADE MARK
J.M.T.
REGISTERED
A GUARANTEE OF QUALITY

Relief Valve.

Brass Wheel Handle.
Gauge Cock

Genuine
Hancock Inspirator.

Steam and Oil
Separator.

J. M. T.
SWING CHECK VALVES
Adjustable Lift.

Pop Safety Valve.

J. M. T. INJECTOR.
(Improved.)

Water Gauge Mounting
Brass Wheel Handles.

Check Valve
with Drip Cock.

Water Column
with high and low
Whistle Alarm.

Oil Cap—Quick
Stop, Sight Feed.

Lever Throttle
Valve.

"Gem" Ejector.

The Quality is a Positive Assurance of Reliability and Long Service

Morrison's Engineers' Supplies are a line of proven merit—a line that makes good by giving satisfaction everywhere.

If you are not familiar with our lines you will do well to get acquainted **at once.**

Our Brass Goods, Pipe Fittings and Tools meet the complete approval of the most particular buyers.

Send us your enquiries on any line or lines in which you are interested.

The James Morrison Brass Mfg. Co., Ltd.
93-97 Adelaide Street West, Toronto

The advertiser would like to know where you saw his advertisement—tell him.

ALPHABETICAL INDEX ON LAST PAGE

BUYERS:—Refer to our Classified Index of Articles Advertised on last few pages.

THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas Electric, Air and Water Power; and to the operation of Refrigerating Machinery.

Published by The MacLean Publishing Co., Limited.

MONTREAL: Eastern Townships Bank Bldg. TORONTO: 143-149 University Ave. LONDON, ENG.: 88 Fleet St. E.C. WINNIPEG: 34 Royal Bank Bldg.

Vol. VI. Publication Office, Toronto—October, 1913 No. 10

TRADE PENBERTHY MARK

"ALL QUALITY LINES"

Guaranteed for 200 pounds working pressure.

TRADE PENBERTHY MARK

"ALL QUALITY LINES"

Guaranteed for 200 pounds working pressure

REGRINDING CHECK VALVES

VIZ:

SWING HORIZONTAL ANGLE VERTICAL

Approved by and Registered in

The Provinces of Ontario, Alberta and Saskatchewan for steam pressures as high as 200 lbs.

Design, workmanship, finish unequalled anywhere. Regrinding easily and quickly done at no extra expense, thus prolonging the life of the valve.

"Up to the Penberthy Standard of Excellence."

Specify them if you want the best check valves.

Write for catalog to-day. It's free for the asking.

Penberthy Injector Co., Limited - Windsor, Ont.

PUMPING EFFICIENCY

HONEST HYDRAULIC PACKING

"Not an ounce of power wasted!-
That's "HONEST JOHN!"

MANUFACTURED EXCLUSIVELY BY

PEERLESS RUBBER MANUFACTURING COMPANY

16 WARREN ST., NEW YORK.

FOR SALE EVERYWHERE

The advertiser would like to know where you saw his advertisement—tell him.

McEWEN ENGINES

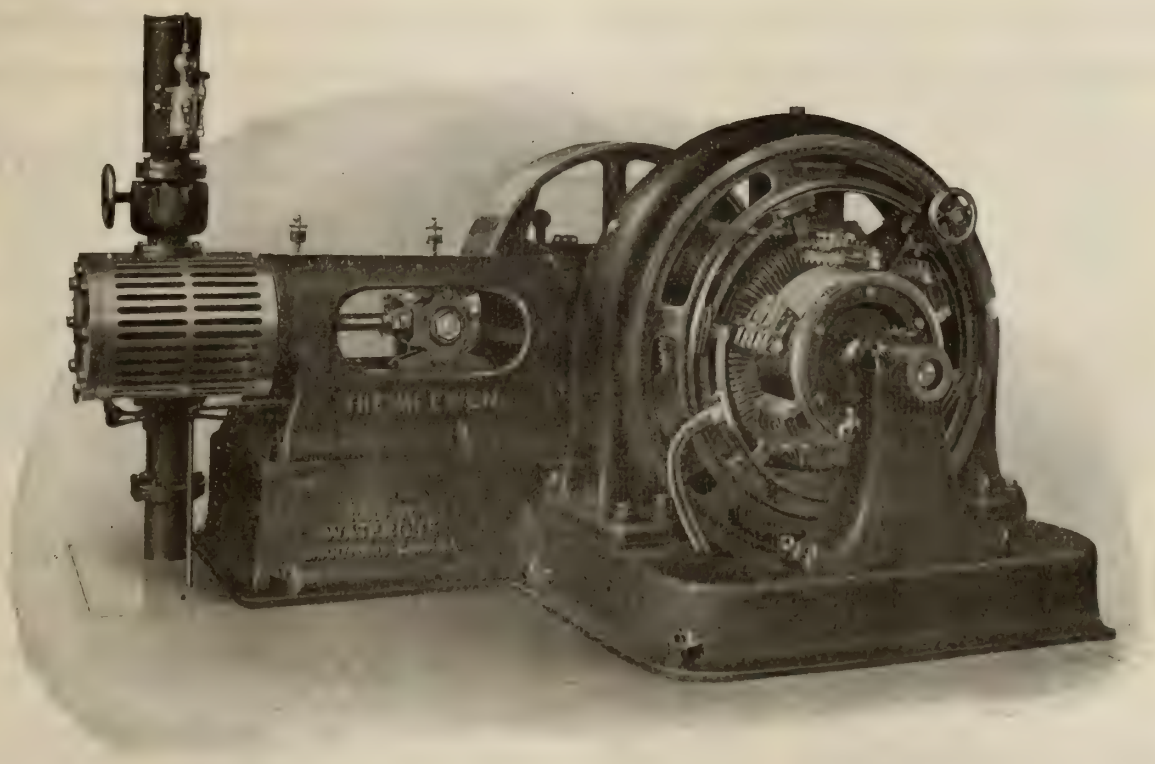
FOR ISOLATED PLANT USE

A McEwen in your Engine Room means economical power—and lots of it—all the time. Every dollar you put into your McEwen Engine you take out in continuous satisfactory, seven-day-in-the-week service.

Smooth, powerful, easy-running McEwen Engines improve with use. They are sold on a reputation for economy and efficiency, and are built and designed to *maintain* it year after year.

Hundreds of users in Canada will testify to this.

Our McEwen booklet is compact, well illustrated and interesting. It tells you what you want to know about McEwen Engines. Write for it.



THE WATEROUS ENGINE WORKS CO., LTD.

BRANTFORD, CANADA

The advertiser would like to know where you saw his advertisement—tell him.

The Dunham Air Line Valve

¶ Passes all air.

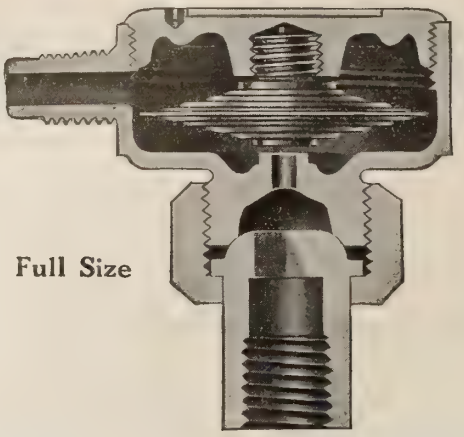
¶ Closes against steam.

¶ Has large valve opening, allowing quick discharge of air from radiator.

¶ Will not clog up.

¶ Is constructed of highest quality material and workmanship.

¶ Is guaranteed, for five years and any valves proving defective within that time will be replaced with new ones free.



Full Size

Trial Offer

If you are having trouble with the valves on your radiators and are continually adjusting them in order to get circulation of steam;

If you are anxious to save the time which you now spend adjusting these valves and wish to rid yourself of the annoyance of these complaints;

Then we will supply you a Dunham Air Line Valve for sixty days Free Trial. *Write To-day.*

Put the Dunham Valve or Radiator Trap in the hardest service. Years of satisfactory service has proven its Sterling Worth.

Ask for New Catalog Bulletin.

C. A. DUNHAM CO., Limited, Toronto, Can.

Halifax Montreal Ft. William Winnipeg Calgary Vancouver

Sales Over Five Million Dollars Annually

Four Babbitt Manufacturing Plants

TORONTO LONDON, ENG. NEW YORK ST. LOUIS

Faultless "A" This babbitt is a high grade copper hardened alloy, possessing in a higher degree all the good points of the original Genuine Babbitt, with increased antifriction qualities, having the additional merit of absorbing and holding oil. It is used extensively in France for automobile engines, and in South Africa for mining machinery, and in United States and Canada for marine engines, dynamos and all heavy duty machines. Where heavy service is required this will last longer than any Genuine Babbitt manufactured. For heavy duty, saw mills and engines it is without equal.

Eagle "A" Thousands of tons of this alloy have been placed on the market, giving such perfect results, that it's name and merits are known, we believe, as extensively as any other babbitt manufactured. Its high antifriction and heavy duty qualities make it especially adapted for saw-mills, planing-mills, threshing engines, traction engines, pumps, rolling-mills and general machine shop use.

HOYT METAL COMPANY

TORONTO OFFICE AND MFG. PLANT—EASTERN AVE. AND LEWIS ST.

The advertiser would like to know where you saw his advertisement—tell him.

JENCKES Boilers

Horizontal Tubular

Vertical Tubular

Flange quality steel, conforming to manufacturers' standard specification, is used in sheet and heads. The tubes are lap welded of standard gauge and make; the rivets of special quality rivet steel, and the stays of steel without welds.

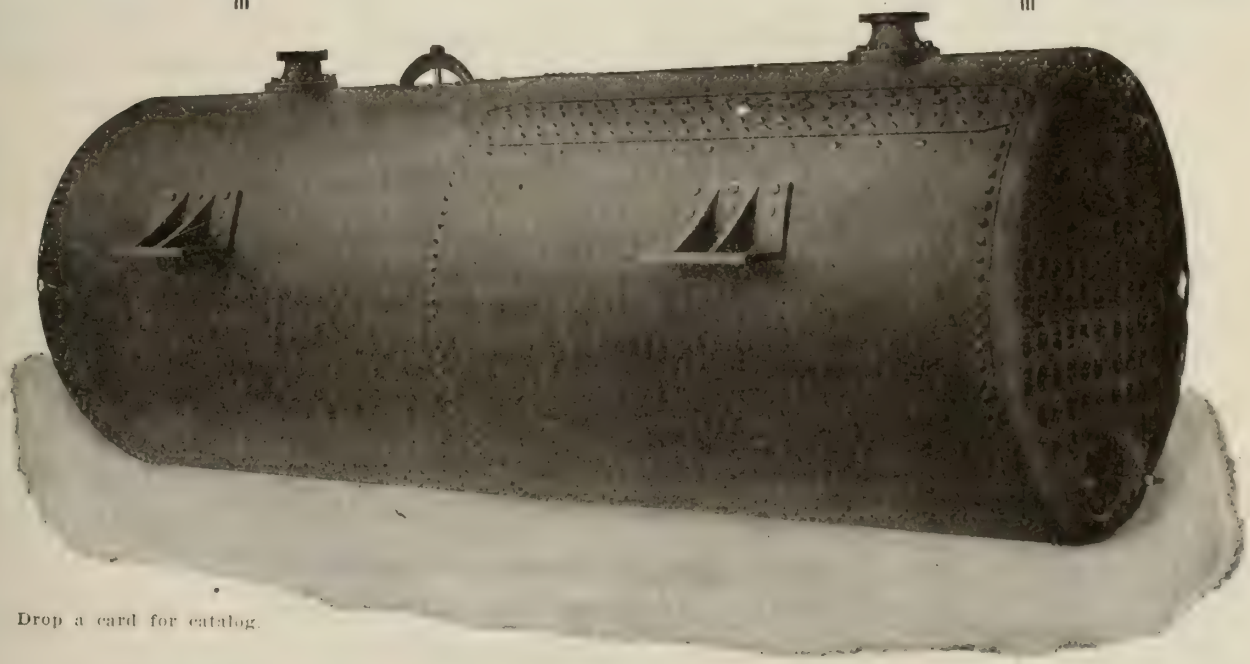
All this goes to make Jenckes boilers exceptionally strong and durable.

We build boilers to conform with the various provincial inspection acts, and put them to a most rigid test before they leave our plant.

Every prospective boiler buyer should investigate the "Jenckes." We will take pleasure in putting you in touch with users.

Locomotive Types

Heating Boilers



Drop a card for catalog.

The Jenckes Machine Co., Limited

Sherbrooke Montreal St. Catharines Cobalt South Porcupine Nelson Vancouver

Works: SHERBROOKE, QUE. ST. CATHARINES, ONT.

POTATO SCALE BOILER CLEANSER

The Only Real Boiler Compound

Is Used by Thousands

Gives Satisfaction Everywhere

Rids Boiler of all dirt mud and scale, never foams, saves fuel and labor, just what you are looking for.

Sold under a Guarantee to give entire Satisfaction or not to be paid for.

Ask us for a sample of our NUMIDIAN CYLINDER, VELOX ENGINE and SLIPIVITY MACHINE OILS. These oils form a triple combination that is hard to beat. Once you have tried them we are confident of your regular patronage.

C. C. SNOWDON

Refiner, Importer and Manufacturer of

Pennsylvania Lubricating and Refined Oils, Gasoline, Potato Scale Powder, Liquid Soap, Disinfectants, Polish, Waste, Oil Tanks, Etc.

1810-1840 11th STREET EAST, CALGARY, ALBERTA

P. O. Box 1384

Branches: Edmonton, Vancouver, Winnipeg

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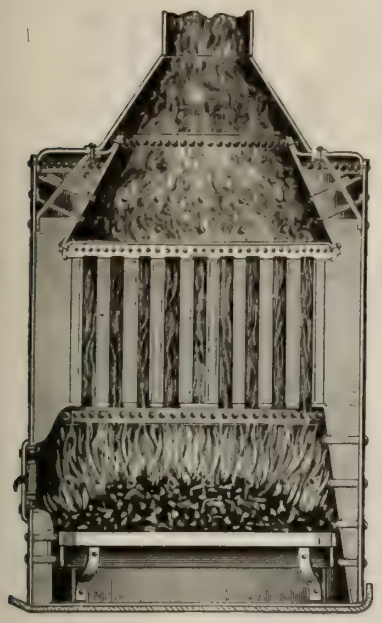


You Will Benefit By

a thorough investigation of our boilers.

They are the result of long experience, best materials and expert supervision.

Look up the past and present record of our boilers.

We will take the greatest pleasure in getting you in touch with some users—the evidence of users will cost you nothing. Our boilers will do the same for you as they do for others.

WRITE TO-DAY.

We build various types:

Scotch, Clyde, Fitzgibbon, Vertical, Mosher.

Highest Grade BOILERS

Horizontal, Tubular, Vertical, Locomotive Type, "Heine" Water Tube.

Polson Iron Works,

LIMITED

Steel Shipbuilders, Engineers and Boilermakers

TORONTO, CAN.

Representatives in Canada for

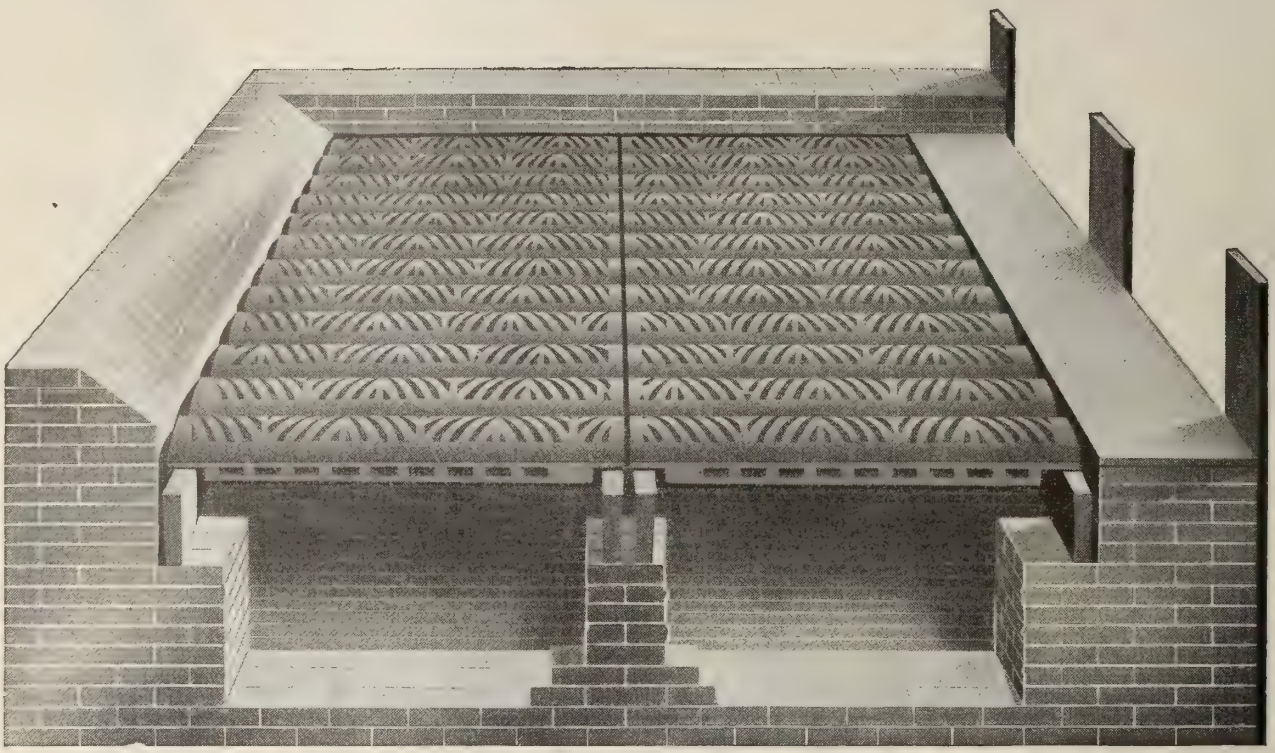
The B. F. Sturtevant Co., Hyde Park, Mass., U.S.A. Fans, Blowers, Heating and Ventilating.

The John I. Thornycroft Co., London, Eng., Marine Motors.

THOMAS ELLIPTIC GRATE BARS

SHAKING—CIRCLE—STATIONARY

FOR EVERY FUEL



THOMAS IDEAS

PATENTED

THOMAS ELLIPTIC GRATE BARS	INCREASE STEAM—SAVE FUEL—SAVE LABOR —COST LESS—REDUCE SMOKE.
THOMAS GRATE RESTS	EVERLASTING—PRESERVE GRATE BARS—PROTECT FIRE WALLS.
THOMAS FURNACE SETTING	FIRE WALLS—BRIDGE WALL—FRONT WALL independent of all expanding and contracting irons. SEE THAT AIR SPACE COMPLETELY ENCIRCLING THE GRATE AREA. No dead and burned grate bar ends. No pushed down walls from expansion of grates.

Shipped from Hamilton, Ont. **Let us give you complete information.**

FOR ALL PROBLEMS

Steam—Grate Bar—Furnace—write THOMAS

The General Supply Co. of Canada, Ltd.

OTTAWA TORONTO WINNIPEG

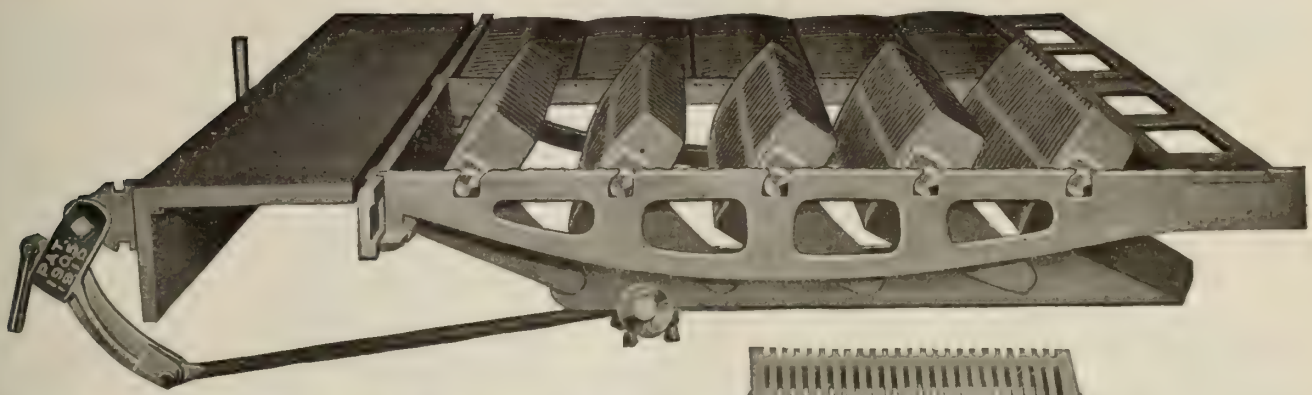
THOMAS GRATE BAR CO., **Birmingham, Ala., U.S.A.**

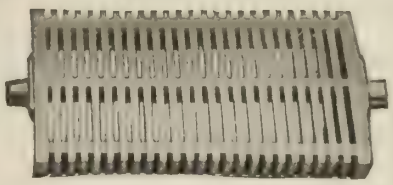
Cut Down That Big Fuel Bill !

The Simple and Effective Way is to Use

"THE Cyclone"

Shaking and Dumping Grate Bar





Burns the Cheapest Grades of Fuel With Results Equal to That of the Best

The Cyclone embodies an immense improvement in the shaking apparatus, whereby all the ashes are passed through the grate without the loss of fuel.

It increases the production of steam for amount of fuel consumed, and allows 68 per cent. of air space, and 90 per cent. underdraught.

"Cyclone" Grate Bars lock level and cannot get out of adjustment or become warped.

There are imitations on the market—beware of them. Instal only the genuine Cyclone—the dependable, economical and long service grate.

No shut down of your plant necessary for their installation, and no expensive charges for brickwork needed. We instal when most convenient to you.

If you wish, we will put in a Grate on the have to-make good basis.

Ask for catalogue and list of users.

The Canadian Steam Boiler Equipment Co., Limited

SOLE MANUFACTURERS FOR CANADA

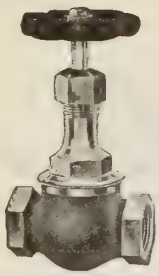
211 QUEEN STREET EAST :-: :-: :-: TORONTO, CANADA

AGENTS

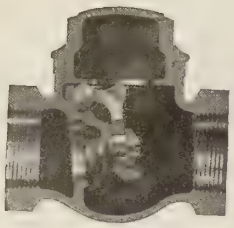
ST. JOHN, N.B., F. W. Blizard, Canada Permanent Chambers. MONTREAL, H. L. Peiler & Co., 308 St. James Street.
HAMILTON, Robt. Fitzsimmons, 8 Grove Street. CALGARY, Alta., The Western Foundry & Metal Co., Limited.
BERLIN, J. Hainsworth, 14 Foundry Street. WINNIPEG, Vulcan Iron Works.

JENKINS BROS.'

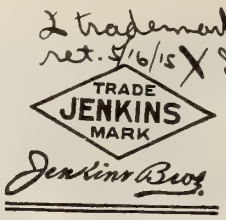
GENUINE BRASS VALVES DIAMOND BRAND



Globe Screwed, Fig. 106.
Globe Flanged, Fig. 107.



Horizontal Check Screwed, Fig. 117.
Horizontal Check Flanged, Fig. 120.



Type "K" Gate Screwed, Fig. 300.
Flanged, Fig. 301

Swing Check Screwed, Fig. 475.
Swing Check Flanged, Fig. 476.

Angle Screwed, Fig. 108.
Angle Flanged, Fig. 109.

Approved for use in the Province of Alberta

Fig. No.	Size.	Pressure (Steam)	Record No.
106-7	¼" — 3"	175 lbs.	430
117-120	¼" — 3"	175 lbs.	432
475-6	¼" — 3"	175 lbs.	440
108-9	¼" — 3"	175 lbs.	431
300-1	¼" — 2½"	125 lbs.	439

Approved for use in the Province of Saskatchewan

Fig. No.	Size.	Pressure (Steam)	Record No.
106-7	¼" — 2½"	175 lbs.	2145
117-120	¼" — 3"	175 lbs.	2146
475-6	¼" — 3"	175 lbs.	2156
108-9	¼" — 2½"	175 lbs.	2147
300-1	¼" — 2½"	125 lbs.	2155

Approved for use in the Province of Ontario

Fig. No.	Size.	Pressure (Steam)	Record No.
106-7	¼" — 3"	175 lbs.	46
117-120	¼" — 3"	175 lbs.	49
475-6	¼" — 3"	175 lbs.	47
108-9	¼" — 3"	175 lbs.	51
300-1	¼" — 3"	125 lbs.	45

SPECIAL FEATURES

Made from the highest grade steam metal. Workmanship unequalled. Follower in stuffing box. Heavy thread on spindle. Long thread on pipe ends. All parts renewable and interchangeable. Fitted with genuine Jenkins Discs (excepting gate valves, which have bronze discs).

A FAIR OFFER

If you will put a JENKINS BROS'. valve on the worst place you can find, where you cannot keep other valves tight, and if it is not perfectly tight or does not hold steam, oils, acids, water or other fluids longer than any other valve, YOU MAY RETURN IT AND YOUR MONEY WILL BE REFUNDED.

All Genuine Valves have our Diamond Trade Mark cast on the body as shown in the cuts, and are stocked by all first class dealers.

DO NOT ACCEPT SUBSTITUTES

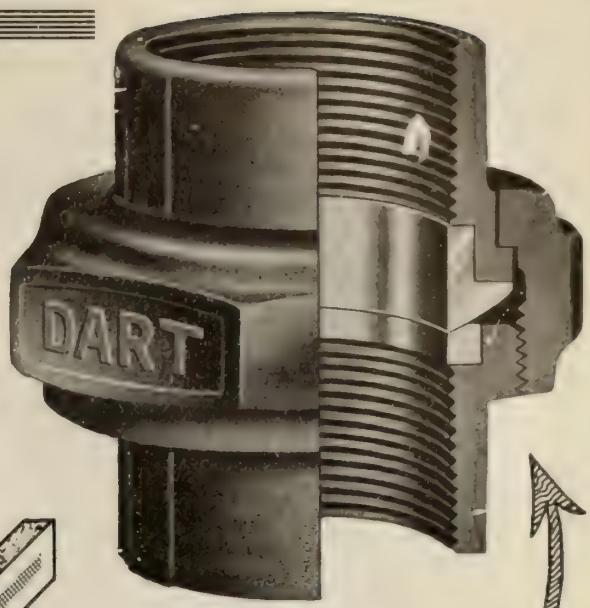
CATALOG MAILED FREE UPON REQUEST

JENKINS BROS., LIMITED

103 ST. REMI ST. MONTREAL

BRONZE TO BRONZE

AT THE JOINT



Never Leaks, Rusts or Corrodes

Corrosion, Expansion or Vibration Do Not Affect It

DART

Union Pipe Coupling

Permanently tight connections are always made with Dart Unions.

There is no deterioration of any kind at the joint.

The Ball-Shaped seat allows a quickly and easily made joint whether pipes are in or out of line, so long as the nut can be started on its thread.

Our trade mark is cast on every union —it's your guarantee. If any union bearing this mark is found defective, we will promptly replace it with two new ones.

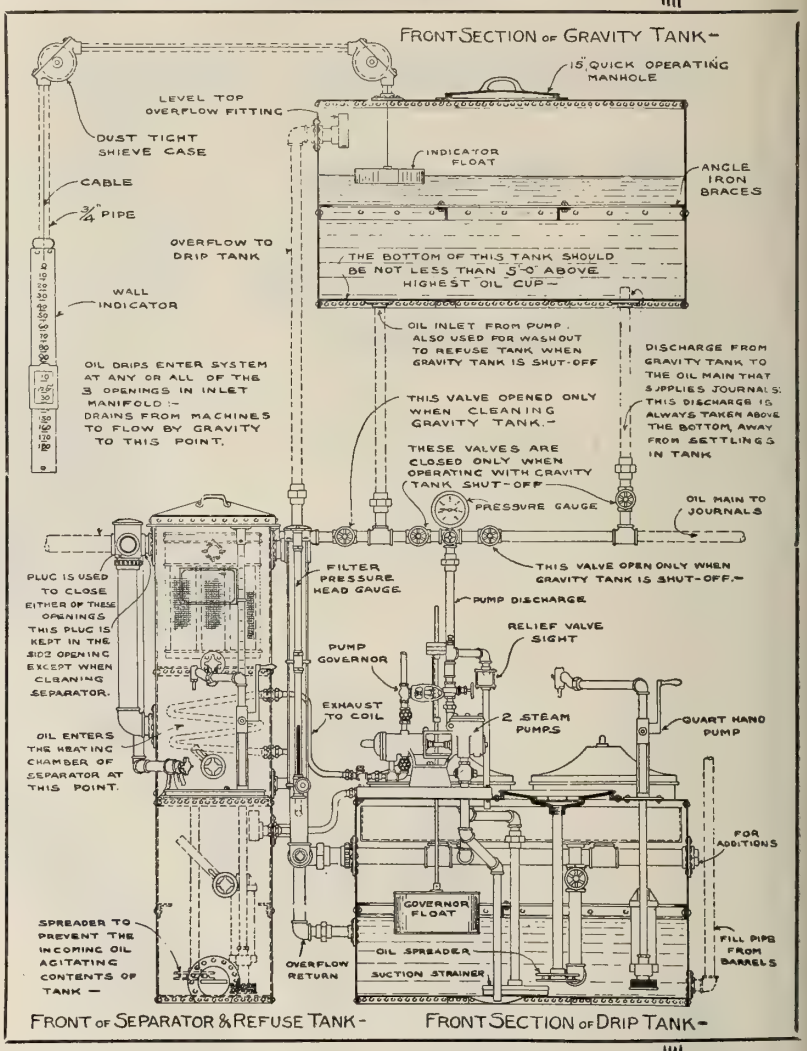
Your jobber has them in all convenient types.

Dart Union Co., Limited

TORONTO, CANADA

The advertiser would like to know where you saw his advertisement—tell him.

With A Bowser System You Are SURE of 100% Lubricating Efficiency


FRONT SECTION OF GRAVITY TANK
15" QUICK OPERATING MANHOLE
LEVEL TOP OVERFLOW FITTING
DUST TIGHT SHIEVE CASE
INDICATOR FLOAT
ANGLE IRON BRACES
CABLE
3/4" PIPE
OVERFLOW TO DRIP TANK
THE BOTTOM OF THIS TANK SHOULD BE NOT LESS THAN 5'-0" ABOVE HIGHEST OIL CUP
WALL INDICATOR
OIL INLET FROM PUMP ALSO USED FOR WASH OUT TO REFUSE TANK WHEN GRAVITY TANK IS SHUT-OFF
DISCHARGE FROM GRAVITY TANK TO THE OIL MAIN THAT SUPPLIES JOURNALS: THIS DISCHARGE IS ALWAYS TAKEN ABOVE THE BOTTOM, AWAY FROM SETTLINGS IN TANK
OIL DRIPS ENTER SYSTEM AT ANY OR ALL OF THE 3 OPENINGS IN INLET MANIFOLD :- DRAINS FROM MACHINES TO FLOW BY GRAVITY TO THIS POINT.
THIS VALVE OPENED ONLY WHEN CLEANING GRAVITY TANK.-
THESE VALVES ARE CLOSED ONLY WHEN OPERATING WITH GRAVITY TANK SHUT-OFF
PRESSURE GAUGE
OIL MAIN TO JOURNALS
PLUG IS USED TO CLOSE EITHER OF THESE OPENINGS THIS PLUG IS KEPT IN THE SIDE OPENING EXCEPT WHEN CLEANING SEPARATOR.
FILTER PRESSURE HEAD GAUGE
THIS VALVE OPEN ONLY WHEN GRAVITY TANK IS SHUT-OFF.-
PUMP DISCHARGE
RELIEF VALVE SIGHT
PUMP GOVERNOR
EXHAUST TO COIL
2 STEAM PUMPS
QUART HAND PUMP
OIL ENTERS THE HEATING CHAMBER OF SEPARATOR AT THIS POINT.
FOR ADDITIONS
GOVERNOR FLOAT
SPREADER TO PREVENT THE INCOMING OIL AGITATING CONTENTS OF TANK —
OVERFLOW RETURN
OIL SPREADER
SUCTION STRAINER
FILL PIPE FROM BARRELS
FRONT OF SEPARATOR & REFUSE TANK -
FRONT SECTION OF DRIP TANK -

Why? Because Bowser means SERVICE—not merely a collection of tanks, pipes, pumps, filtering cloth, etc., or the actual equipment itself — **SERVICE** rendered by experts—men who are capable of devising special systems for particular needs, be they large or small—men who have devoted their lives to solving all sorts and kinds of oil storage and distributing problems.

There may be other ways of obtaining SERVICE, but of this you may be certain: In selecting a Bowser Oil Filtering and Circulating System, you are not experimenting or "trying out"—you are selecting a system that will **render you 100% efficient lubrication.**

In operation each gallon of oil per hour is forced by 36-inch gravity pressure through nearly THREE SQUARE FEET of filtering surface. There is no chance for a grain of dirt or grit to remain in the oil—no possibility of your bearings being injured.

The drip from the bearings is caught and carried back to the filter, using the oil over and over, thus securing perfect lubrication without waste.

An automatically regulated STREAM FEED gives your engine the perfect lubrication it demands and saves the time of the man with the oil can.

As to accessibility for cleaning, you can get at the insides of a Bowser in two minutes—you can clean the filters without interfering with the operation, shutting down or being inconvenienced in any way whatever.

Many think that the cost of a BOWSER Oil Filtering and Circulating System is prohibitive to any but the very large plant. This is a false impression and it may be standing between you and better lubrication and greater economy. It will not obligate you in any way to get all the facts about Bowser SERVICE and it will quite likely prove a step in the right direction for you.

Let us explain Bowser SERVICE to you in detail

S. F. BOWSER & CO., Inc.,

66-68 Frazer Avenue **TORONTO, CANADA**

Made by Canadian Workmen and Sold by Canadian Salesmen

Sales Offices in all Centres and Representatives Everywhere.

Original patentees and manufacturers of standard self-measuring hand and power driven pumps, large and small tanks, gasolene and oil storage and distributing systems, self-registering pipe line measures, oil filtering and circulating systmes, dry cleaner's systems, etc.

Established 1885.

¶ **The Progressive Engineer** benefits by specifying

GARLOCK PACKINGS

among his Engine Room Supplies, because he is guarded against:—

Sunday work and overtime on his Engines and Pumps;

Loss and delay by reason of wasted steam;

Shut downs for repairs, etc., by using Packing of **Known Reliability.**

¶ Deception in the manufacture of packings is easily accomplished and your only protection is to place your confidence in the Packing that for many years has been accepted as *standard* the world over.

¶ Cheap packing always means inferior material, and poor workmanship in its construction.

¶ *Garlock Packing* is not "cheap," but always proves economical to its users. We stand ever ready to back up our claims by allowing our customers ample opportunities to thoroughly test our packings.

Write to-day for the Garlock catalog. It's interesting.

The Garlock Packing Company

HAMILTON, ONTARIO

Winnipeg **Toronto** **Montreal**

"Pioneers in the Packing Business"

The advertiser would like to know where you saw his advertisement—tell him.

Stop Blow-outs and Leaks in Pipe Lines by Using GOETZE No. 2 ELASTIC GASKETS

If you start right now to renew with No. 2 ELASTIC GASKETS, you can steadily reduce your renewals until you have brought them almost to the vanishing point.

This is not a mere "claim"—it is backed up by a *guarantee*—in fact the strongest guarantee ever made by a gasket manufacturer.

Think what it means to re-gasket a joint so it will *keep tight for years,* instead of days or weeks. Think of the saving resulting in gasket costs, labor and shut-downs.

What No. 2 Elastic Gaskets Will Do

No. 2 ELASTIC GASKETS will make the most troublesome joint you have absolutely tight — and keep it so. They "stay put" and stay tight. Prevent leaks, blow outs and shut-downs. Will practically eliminate renewal expense for gaskets.

No. 2 ELASTIC GASKETS are for high pressure and super-heated steam lines, but owing to their indestructible nature, are equally adapted to *any and every condition* about a factory, mill or refinery.

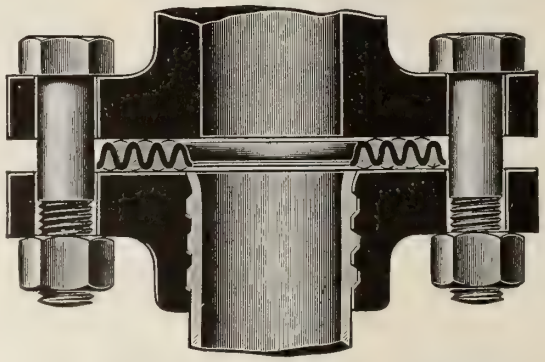
The No. 2 Elastic Guaranteed

Every No 2 Elastic Gasket is Guaranteed for 5 Years Continual Service in the Same Joint

There are no "ifs and ands" about this guarantee. It means just what it says. It applies to every No. 2 GASKET whether bought direct from us or through a dealer.

How No. 2 Elastic Gaskets are Made

These Gaskets are made of corrugated copper with asbestos lining No. 2. The corrugations allow for expansion and contraction of the pipes, while the asbestos, being forced into the



pores of the metals in the flanged surface by the "squeeze" and the constant pressure of the corrugations beneath it, holds securely against the highest pressures.

Goetze Gaskets are carried in stock by

T. McAVITY & SONS, LIMITED

ST. JOHN, N.B.

MONTREAL
112 St. Peter Street

BRANCHES AT
WINNIPEG
C. E. Chown, 147 Bannatyne Street

VANCOUVER
c/o A. O. Campbell, 1069 Hamilton Street,

MANUFACTURED BY

Goetze Gasket & Packing Co., New Brunswick, N.J.

Money and Labor Wasted

by using a packing not adapted to the conditions.

No ordinary packing will give lasting service under high pressure superheated steam and compressed air pressures.

"PALMETTO"

REG. TRADE MARK

• PACKING •

keeps the stuffing-boxes tight under the most severe conditions because it is heat resisting and carries its own lubricant.

A free working sample will show you what we mean. Let us send you one.

Greene, Tweed & Co.

Sole Manufacturers

109 Duane Street, New York

Canadian Distributing Agents

The Canadian Fairbanks-Morse Co., Limited

Montreal, Ottawa, St. John, Toronto, Winnipeg, Calgary, Saskatoon, Victoria, Vancouver.

A Perilous Situation In The Bay Of Biscay

Crew, Ship and Cargo Saved By Magnolia Metal

944 E. 180th St.,

New York, N.Y., June 8th, '912.

Gentlemen:—

I am only too pleased to give my experience with Magnolia Metal for it may help another Engineer out of a tight place.

A steamer in a gale in the Bay of Biscay on a lee shore about 7 miles distant, which meant if we had stopped we would have been on the rocks in an hour. The high pressure crank pin of the 2,000 h.p. triple expansion engine got hot from the heavy racing of the engines due to the violent pitching of the vessel. All the bearings of these engines were Magnolia lined. With this crank pin we put on the hose and used liberally graphite and machine oil and the bearing was cool in an hour and we ran for 96 hours full speed before we took it down and then just a slight film of the metal had wiped off which relieved the bearing and permitted us to run without the engine pounding too heavy.

My experience has been with other metals once they get hot—all or nearly all the metal runs out and some of the metal runs into the oil pipe and stops the lubricant from reaching the bearing and the engine must be stopped. The bearing dressed and adjusted on the engine will pound itself to pieces so you see in the instance I have mentioned Magnolia deserves all the praise anyone can give it. Since that time I have had Magnolia act the same on stationary engines and about nine months ago on a 2 15-16 shafting hanger and after the day's run was over took the box and cleared away the metal which had wiped off and put box back into service again.

Respectfully,

HAROLD JAMES

SOLD BY LEADING DEALERS EVERYWHERE OR BY

MAGNOLIA METAL CO.

OFFICE AND FACTORY:

225 St. Ambroise St. - MONTREAL

The advertiser would like to know where you saw his advertisement—tell him.

A Simple Way To Make Packing Last

No rod packing can be so saturated with lubricants as to make it "self-lubricating" during its entire "life," unless that "life" be short.

While the very finest of lubricants are used in P.P.P., and in as great quantity as can be put in any packing, yet on account of the fact that P.P.P. lasts for months—usually a year or more—we suggest the liberal use of a high-grade cylinder oil as a means of extending this service. Should it be necessary to remove P.P.P. from the stuffing-box, the packing should be dipped in oil before replacing in the engine.

DANIEL'S ROD PACKING P. P. P. COIL RING SPIRAL

Simply on the basis of length of service, P. P. P. is by all odds the **lowest-cost** packing made, but the real, the BIG saving is in the fact that the "sliding wedges" and "compressible cushion" of P. P. P. save more than 75% of the friction, as there is practically no pressure on the rod during the **forward stroke** and just enough to hold steam-tight during the **backward stroke.**

Solid packings and imitations of P. P. P. constructed on the wrong principle and cheap materials, maintain a fixed and unvarying pressure on the rod during the entire piston travel. This means unnecessary friction with the consequent strain on the engine and a waste of the power necessary to overcome this friction.

P.P.P. Good After 4,380,000 Revolutions.

We have a set of P. P. P. Packing which was in use for more than two years in an engine running 300 revolutions a minute, 20 hours daily. This packing is still good for another year or more.

How to Get the "Slide Valve" FREE

Fill out the Coupon, and mail it to us. We will address a book to you, and send it FREE of charge.

Your Name .....

Address .....

Employed by .....

Address .....

Horsepower of Engine .....

Kind of Rod Packing Used .....

Do You Use **EBONITE** Sheet Packing? .....

Dealer's Name .....

Address .....

Name of Buyer .....

..... Series 24-J

DANIEL'S P. P. P. ROD PACKING

is imitated more than any other packing made. But the imitation is in appearance and claims only. None but the genuine gives the results.

QUAKER CITY RUBBER COMPANY

Manufacturers of Mechanical Rubber Goods

PHILADELPHIA	CHICAGO	PITTSBURGH	NEW YORK
629 Market St.	182 W. Lake St.	207 Wood St.	207 Fulton St.

The advertiser would like to know where you saw his advertisement—tell him.

Use Stephenson Bar Belt Dressing

Make 1913 a record breaking year. Turn over a new leaf and get rid of the things that have been causing needless trouble and expense. Adopt the things which will make your work easier, give better results and save money for your employer. You cannot start at abetter place than with your belt dressing.

Get rid of your troublesome liquid dressing. Shake the can for the Stephenson solid stick and shake trouble at the same time.

Stephenson Bar Belt Dressing is a friend in need. It doesn't require preparation, nor do you have to use special care in applying it. The minute the belt slips you hold the Stephenson bar to the belt for a few seconds and the slipping stops. There's no waste—no slop—no smearing on of paste or pouring on of spattering liquid. And the results are better.

I'll **"Stick to the Solid Stick"**

Start With a Free ½ Lb. Sample

Simply send us your name and address and we ll send you a present in the shape of a free half-pound sample of Stephenson Bar Belt Dressing.

Remember—we give you this sample absolutely free of charge. Get this free half-pound of the finest belt dressing made and test it. Here's your chance to try somesomething really good at no expense.

None Genuine Without Trade-Mark

Stephenson Manufacturing Company

Est. 1888 **Albany, N.Y.** **Inc. 1897**

The advertiser would like to know where you saw his advertisement—tell him.

D. K. McLAREN'S

Genuine British-Oak Tanned

Leather Belting

The Kind That Turns Expense Into Profit

A GUARANTEE

That Is Found On Every Piece of D. K. McLaren's Belting.

We invite you to look into the merits of this belting before you buy. Let us get you in touch with users — what our belting does for them, it will do for you.

The secret of the efficiency and durability lies in the fact that our **solid** oak tanned belting is tanned by the old-fashioned slow process, using genuine oak bark.

D. K. McLaren's Oak Tanned Leather Belting delivers the **maximum amount of power per every day of service,** and its lasting qualities mean an enormous yearly saving of time and money.

Beware of pickled belting.

It is made from leather that is tanned (?) by a rapid acid process — a process that takes the life out of leather.

When you get D. K. McLaren's Genuine British Oak-tanned Leather Belting you get the **greatest belt value** on the market.

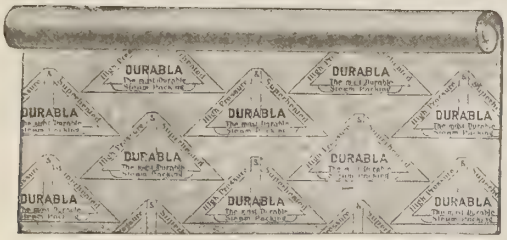
Every inch of this belting is carefully stretched before it leaves our plant, ensuring minimum stretch when in service.

D. K. McLAREN Limited

Montreal	Toronto	Vancouver	St. John, N.B.
351 St. James St.	200 King St. W.	37 Alexander St	64 Prince William St.

The advertiser would like to know where you saw his advertisement—tell him.

DURABLA



Registered Trademark Stamped all Over

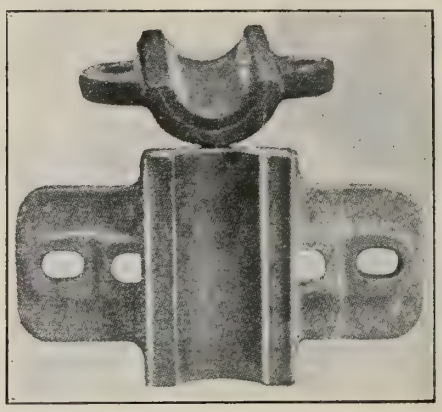
You Can Rely Upon DURABLA SHEET PACKINGS

on Superheat and High Pressure, Wet Steam and Oil. It makes tight joints and keeps them tight. Never pulps! Never blows out!

DURABLA MANUFACTURING CO.
114-118 LIBERTY ST., NEW YORK
Canadian Sales Agents
CANADIAN FAIRBANKS-MORSE CO.
Montreal, Ottawa, Calgary, St. John, Toronto, Saskatoon, Quebec, Winnipeg, Vancouver.

GRAPHITOL

Pat. and Trade Mark Registered.



New Anti-friction Material Bearing.

Graphite is nature's greatest lubricant.

Pure graphite hardened in the **Graphitol** way makes the most frictionless machinery bearings possible.

Graphitol has recently been improved to such a degree of excellence that it is becoming of unquestioned value for many purposes.

Graphitol is shipped in powder form, is mixed with a prepared liquid when required, and applied in paste form, when it hardens durably.

Graphitol bearings mean reduced initial cost, greater efficiency, less oil, and cool running.

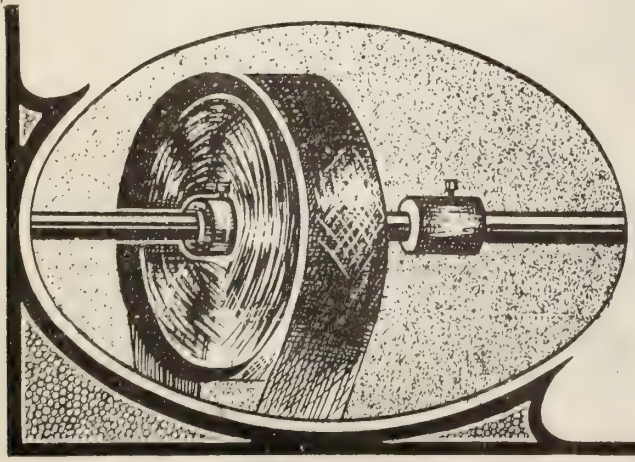
Write for free illustrated pamphlet, to

BRITISH PACIFIC SUPPLY CO.
F. C. Winkler, Manager
VICTORIA, B.C.

SPARTAN BELTING

Repeatedly Outwears Three Ordinary Belts—It's Not Affected by Steam, Water, Oil, Gas or Acid Fumes and Is Especially Adapted For Any Hard Service

For service under abnormal conditions where the life of the average belt is limited frequently to weeks, the Spartan has swept all before it, repeatedly outwearing three ordinary belts, obviating expensive shut-downs.



Spartan Belting, by its thousands of users, is conceded to be without an equal for successfully meeting the most exacting requirements.

Why not pick out one of those exacting or troublesome drives in your plant and let us prove to you the efficiency of the **Spartan Brand?** Anyhow let us send further particulars, together with copy of our Spartan Book. **Write to-day.**

1851 G & K TRADE MARK

The Graton & Knight Mfg. Co.
Oak Leather Tanners and Belt Makers,
Worcester, Mass., U.S.A.
Note: **There is a G & K belt for every drive.**

Note that Groove

It Minimizes Power Waste by Minimizing Belt Slip

Belt slippage is often caused by air getting between the belt and the pulley face. This "air pocket" lifts the belt, lessens the gripping surface, and weakens the belt grip.

"AMERICAN" STEEL SPLIT PULLEYS

Perfect in Principle Powerful in Performance

are constructed with a grooved "air escape." This not only improves belt contact, but strengthens the pulley by providing a turned-in flange, to which are riveted the spider arms.

"American" Pulleys are light, strong, practically indestructible, and guaranteed for double belt service under any conditions not requiring a special pulley.

Write for "Factors of Energy"—a little, useful book.

THE AMERICAN PULLEY COMPANY

OFFICE AND WORKS, PHILADELPHIA, PA., U.S.A.

Large stocks of "American" Steel Split Pulleys are carried at the following warehouses, insuring prompt shipment to customers.

CANADIAN DEALERS:—Williams & Wilson, Limited, Montreal, Quebec; A. R. Williams Machinery Co., Limited, Toronto, Ont.; St. John, N.B.; Winnipeg, Man.; Calgary, Alberta; Vancouver, B.C.

PATENTED

DEALERS EVERYWHERE

"Maple Leaf" Brand

Stitched Cotton Duck Belting

THE BEST FOR ALL KINDS OF BELTS

Means Reduced Upkeep Expense and Efficient Service

TO THE HARDWARE TRADE—

Look over your stock and send your orders in NOW for **"MAPLE LEAF" BELTING** and **BELT DRESSING,** so as to insure delivery within a reasonable time.

Ask us for further information and prices.

Dominion Belting Co., Ltd.,

HAMILTON, CANADA

The advertiser would like to know where you saw his advertisement—tell him.

THE TRIPLEX BLOCK

The Best Practice in Power Plants

THE new book of Hoists shows modern boiler room installation for handling coal by electric hoist and trolley. Under 4,000 lb. loads these hoists travel 350 feet per minute from bunkers to furnace, controlled from the floor or from a trailer cage.

Both for the Power Plant or Marine Engineer this book shows the latest application of chain blocks and trolleys to enable one man to lift, move and adjust any load up to 20,000 pounds.

Write for a copy of this book to-day. It will result in decreased costs in handling.

Safety of Steel

The Triplex Block is steel construction—steel in all load bearing parts, sheave, gears, pinion, hooks and chain.

EACH BLOCK TESTED TO 50 PER CENT. OVERLOAD

Yale Products—Locks, Padlocks, Builders' Hardware, Door Checks and Chain Hoists.

Also Duplex Blocks, Differential Blocks and Electric Hoists

The Canadian Fairbanks-Morse Company, Limited

Montreal St. John Ottawa Toronto Winnipeg
Saskatoon Calgary Vancouver Victoria

Bond Maximum Service Hangers

TRADE MARK BOND DOUBLE-SURE QUALITY PATENTED

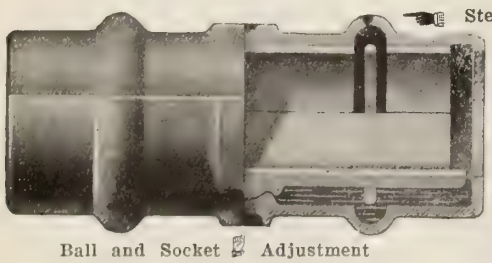
The actual service test has proven Bond Hangers the best.

Why not get fully acquainted with their merits?

They save money, time and trouble everywhere.

Ask for catalogue No. 27.

We have everything in transmission.



ALL BEARINGS REAMED

The "Bond" Patent Universal Ring Oiling Ball and Socket Hanger.

Canadian Bond Hanger & Coupling Co., Ltd.

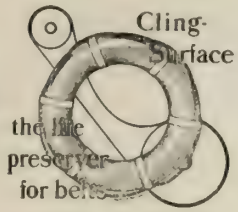
Alexandria, Ontario

$90 to $9000 per year.

Cling-Surface treatment of your belts may save much of this for you every year.

In a 200 h.p. plant operated with tight, untreated belts and friction load of 40 per cent., which is a common figure, treatment of the belting with Cling-Surface will permit slack or easy running, and will reduce your friction load possibly to 20 per cent. The 20 per cent. power saving thus effected, according to the table below, amounts to $720 per year. Isn't that worth while?

This table was compiled on the assumption of 4 lb. of coal per horse power hour, 300 working days per year, 10 running hours per day, and a coal cost of $3.00 per ton.



Horse Power of Plant.	Per cent. saving in power 10 p.c.	20 p.c.	30 p.c.	40 p.c.	50 p.c.
$ 50	$ 90	$ 180	$ 270	$ 360	$ 450
100	180	360	540	720	900
200	360	720	1,080	1,440	1,800
300	540	1,080	1,620	2,160	2,700
400	720	1,440	2,160	2,880	3,600
500	900	1,800	2,700	3,600	4,500
1,000	1,800	3,600	5,400	7,200	9,000

THE SOUTHERN ENGINEER published this practical example in the Jan., 1913, issue:

"A manufacturing plant of 250-horse power nominal rating required an average of 268 horse power for 10 hours a day. The establishment had been run for some 14 or 15 months without any trouble from hot bearings. Friction losses were naturally supposed to have reached the lowest possible figure.

"The question was raised as to the actual losses due to tight and stiff belts. This led to the application of the indicator."

Summarizing, The Southern Engineer found that:

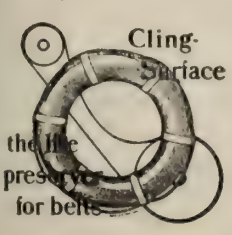
"If the engine required 84 pounds of steam per horse power hour, and 8 pounds of steam were obtained with a pound of coal, it would mean a saving of 1,139 pounds of coal in ten hours. At $3 a ton for coal this means a saving of $1.79 a day, which probably would equal the fireman's wages.

"To the casual observer there had been no unnecessary friction. Everything ran smoothly, cool and apparently with little power. Yet, $1.79 a day, or $537.00 a year was being wasted."

We needn't say more. Cling-Surface would do much in the above plant, and besides it stops slip, waterproofs and preserves belting, and *it makes belts pull without making them sticky.*

Let us refer you to nearby installations where savings have been made in this direction.

Write now for more facts, figures, and literature. We quote f.o.b. Toronto.



Cling-Surface Co

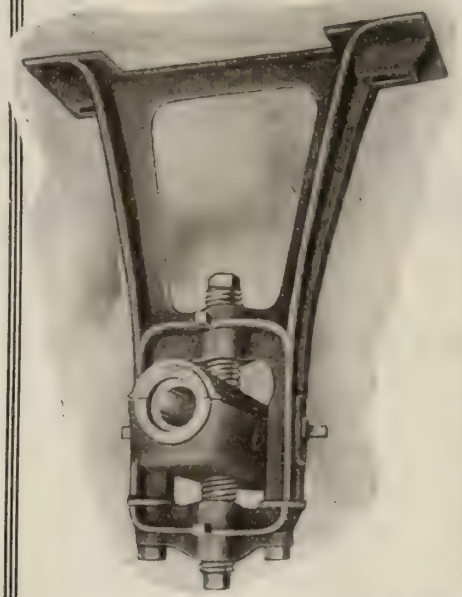
1057 Niagara Street
Buffalo N Y

70

ELMIRA

Ball & Socket HANGERS — **For MAXIMUM Service** — **Wood Split PULLEY**

AND BIG REDUCTION IN POWER TRANSMISSION COST



The "Elmira" Ball and Socket Hanger

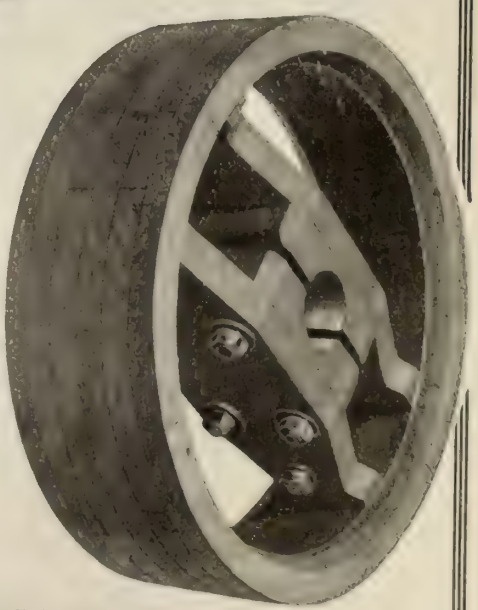
Is exceptionally strong and heavy. In this hanger a union system of oiling is employed, a combination of centrifugal and capillary attraction, effected by tempered steel rings and woven cotton distribution of lubricant, and precludes the slightest possibility of "Dry Bearings" so long as any oil remains in the reservoir or dry chamber, one filling of which should last from **six to twelve months.**

The "Elmira" Wood Split Pulley

You can use an "Elmira" Pulley any place that a leather belt will give satisfaction, and know that what any good pulley will do, it will do, and more.

This pulley **stands the hardest and most severe conditions.** It is nailed throughout. The arms are tenoned into rim and doweled there.

Absolutely guaranteed.



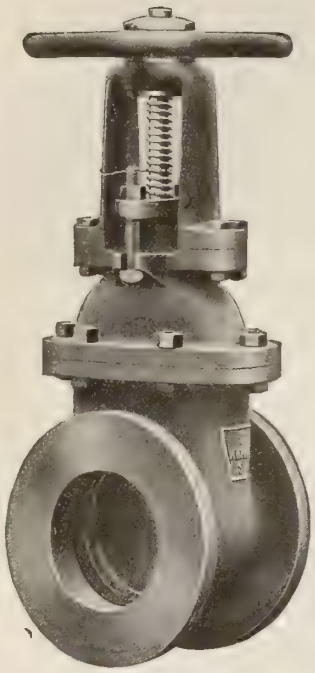
It will be much to your interest to let us furnish you with our illustrated catalog. Write for it to-day.

Large and complete stocks carried at Elmira and by The A. M. Ellicott Co., 301 St. James Street, Montreal, Que., Sole Eastern Agents.

Elmira Machinery & Transmission Co., Ltd.
ELMIRA, CANADA

KERR GATE VALVES

OUTSIDE SCREW AND YOKE
"KEYSTONE" PATTERN
Embody all the latest features



4½-in. and larger

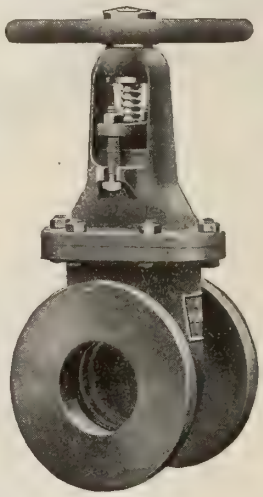
Screwed in Seats

Deep Bronze Bushed Gland and Stuffing Boxes.

Full Opening.

Large Diameter Hand-Wheels.

Solid Wedge Discs.



4-in. and smaller

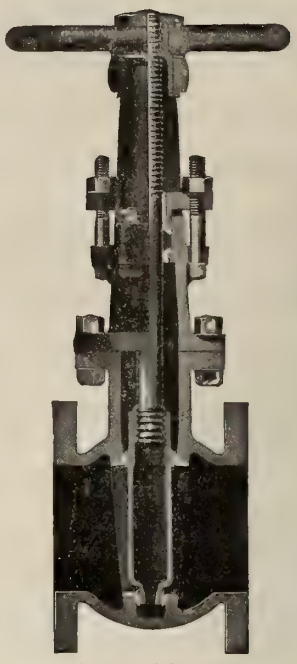
Narrow face-to-face Dimensions

Symmetrical Design.

Good Material.

Interchangeable Parts.

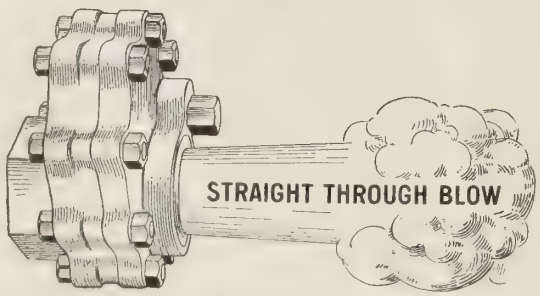
Guaranteed Tested.



4½-in and larger

The Kerr Engine Co., Limited, MANUFACTURERS
Walkerville, Ontario

EVERLASTING
BLOW-OFF VALVES



IT NEVER LEAKS!
WRITE FOR PRICES

200,000 IN USE

Does your Boiler leak, Mr. Engineer?
How often do you blow it?
The "EVERLASTING" is the only perfect blow off valve on the market.
No stuffing box—requires no packing—is self-cleaning, and has a self-grinding seat—nothing to get out of order—What's the answer?

RELIABILITY—SIMPLICITY.

SOLD AND MANUFACTURED UNDER CANADIAN PATENTS BY

Engineering Specialties Company, 1080 King St., West, TORONTO
LIMITED

AGENTS

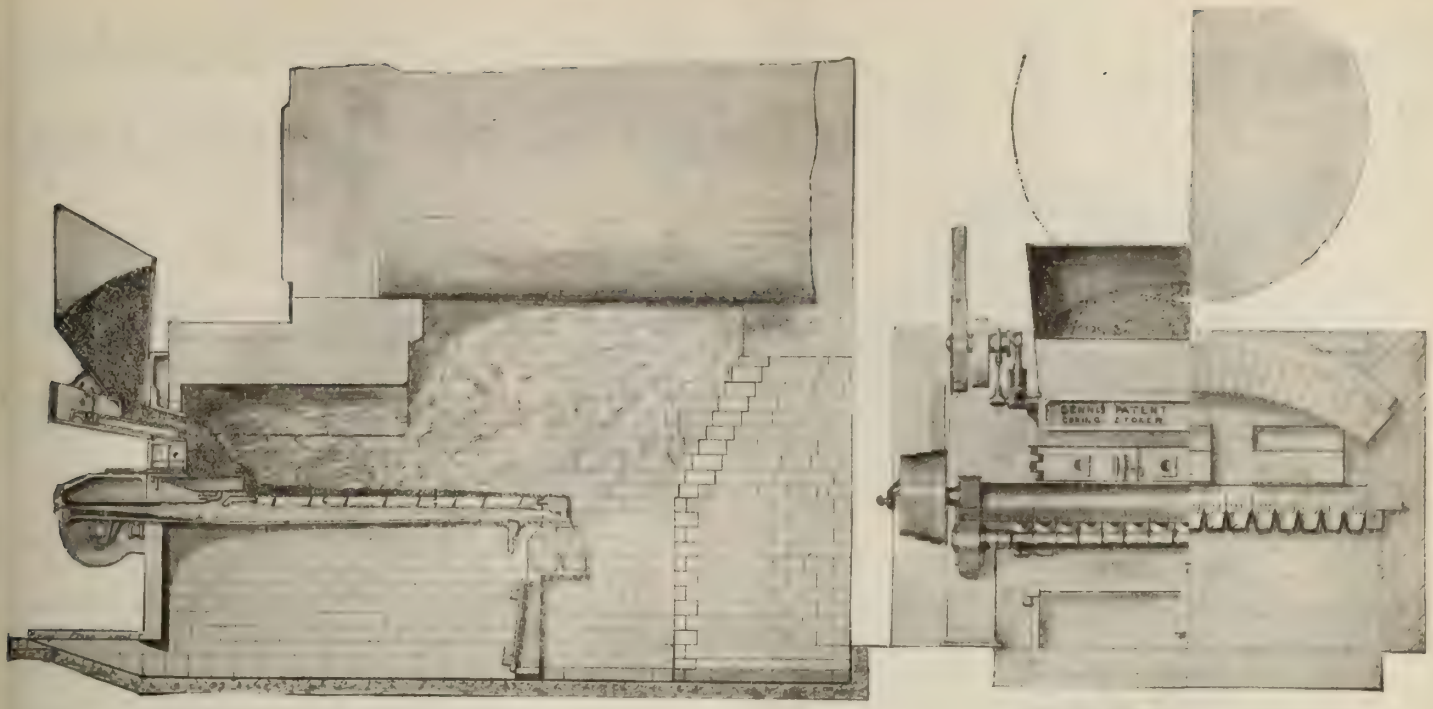
MONTREAL, QUE.
H. L. Peiler & Co.

ST. JOHN, N.B.
The A. R. Williams Mach. Co.

WINNIPEG, MAN.
The A. R. Williams Mach. Co.

CALGARY, ALTA.
P. D. McLaren Limited

VANCOUVER, B.C.
Taylor-Forbes Company, Limited



LONGITUDINAL SECTION FRONT VIEW

ARRANGEMENT OF BENNIS COKING STOKER APPLIED TO HORIZONTAL RETURN TUBE BOILER

MILLIONS OF DOLLARS are SAVED YEARLY by the USE of BENNIS MACHINE STOKERS

WRITE FOR A FULL SET OF "BOILER HOUSE ECONOMY AND CHEAP STEAM" PAMPHLETS TO

G. H. TOD, 213 Manning Chambers Queen Street West **TORONTO**

LUNKENHEIMER
SUPERIOR STEAM BOILER VALVES AND FITTINGS

conform with Canadian Boiler Regulations, and are approved for use in Canadian Provinces, including British Columbia, Alberta, Saskatchewan and Ontario.

The line approved includes Globe, Angle, Cross Check, Gate, Blow-off, Pop Safety, Relief, and Non-return Safety Boiler Stop Valves, Water Gauges, Gauge Cocks, etc.

A complete list of Official Registration Numbers covering the above will be sent upon request.

The supremacy of LUNKENHEIMER PRODUCTS is universally acknowledged, and to maintain this reputation, the highest type of skilled labor is employed, and only new material of the very highest grade is used.

We guarantee our goods to be of the very **highest quality**, and a LUNKENHEIMER GUARANTEE is a real, definite quantity, and not an empty use of the meaning of a guarantee.

All correspondence and inquiries receive prompt attention, and immediate shipments are insured, as large stocks are carried.

Specify and insist upon securing genuine **Lunkenheimer make.** Do not accept substitutes, they are never as good as the genuine.

Write for catalogue, illustrating and describing the complete line of **Lunkenheimer High Grade Products.**

THE LUNKENHEIMER COMPANY

Largest Manufacturers of High Grade Engineering Specialties in the World.

General Offices and Works: CINCINNATI, OHIO, U. S. A.

32-43

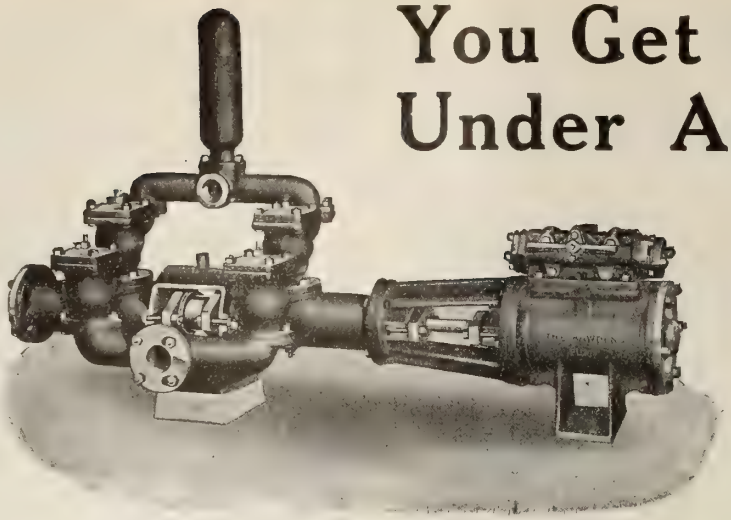
New York,	Chicago,	Boston,	London, S. E.
64-68 Fulton St.	186 N. Dearborn St.	136 High St.	35 Great Dover St.

NO TAPPETS

NO EXTERNAL VALVE GEAR LEVERS OR SPRINGS

NO INTERNAL TUBES OR STUFFING GLANDS

You Get a Full Stroke Under Any Condition



Operated by The Bawden Patent Steam Moved Piston Valves. Controlled by the action of live steam only. Automatically cushioned and will run at any speed without adjusting.

Write for catalogue and prices.

PUMPS FOR ALL PURPOSES

¶ The Bawden pump provides the simplest, most economical, and reliable means for feeding high and low pressure boilers. Greatest economy of steam consumption. Simplicity throughout. No adjustments to make under constant or varying conditions. All parts oiled through the lubricator.

¶ Has no screwed seats on water valves All faces carefully machined. No sheet rubber packing on the pump. Modern designs and construction to meet modern steam pressures. Impossible to short stroke or tie up.

Quebec Agents: H. L. Peiler & Co., 380 St. James St., Montreal

The Bawden Machine Co., Limited Toronto Canada

Marsh Steam Pump

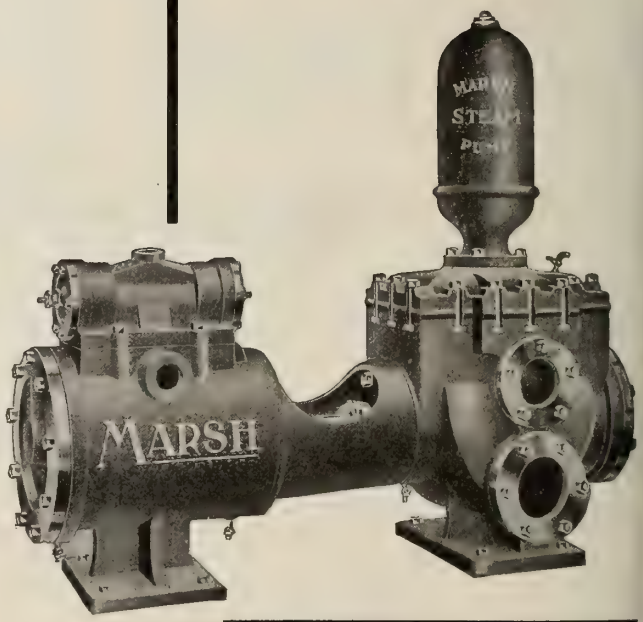
The Pump with the Self-governing Steam Valve

Note the extreme simplicity in construction and the absence of outside valve motion. There is practically nothing to get out of order. Nearly all the wearing parts are made of phosphor bronze instead of common brass, including piston rod, water cylinder lining and valve seats.

The steam valve is self-governing and admits only just enough steam to do the required work. The pump cannot short-stroke, race or pound under the most severe conditions.

115,000 in successful operation.

Ask for Catalog No. 18



American Steam Pump Company

BATTLE CREEK, MICH.

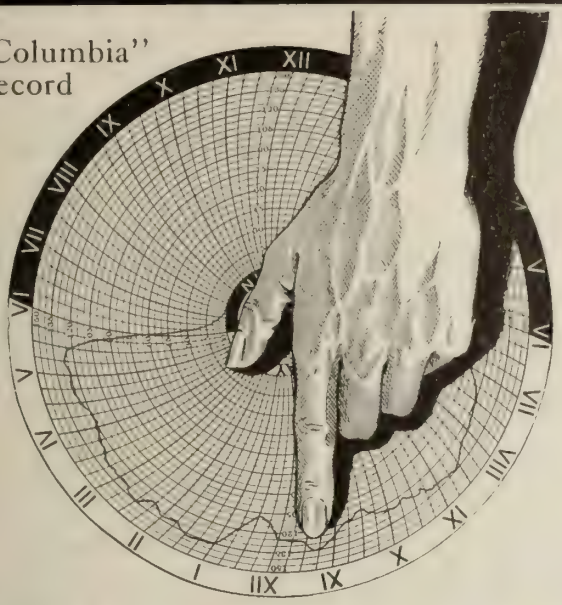
CANADIAN AGENTS

A. R. Williams Machinery Co., Toronto
Williams & Wilson, Montreal
London Engines Supplies Co., London, Ont.
Stuart Machinery Co., Winnipeg
Hallman Machinery Co , Vancouver, B. C.
Mechanics' Supply Co., Quebec, Que.
Gorman, Clancey & Grindley, Limited
Edmonton & Calgary

The advertiser would like to know where you saw his advertisement—tell him.

A Clear, Intelligent Chart Record "COLUMBIA"

A "Columbia" Record

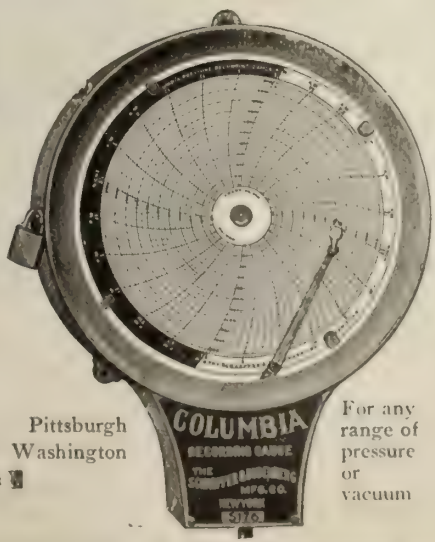


The "Night and Day Chart" which has won for the "Columbia" a good share of its popularity, is only one of its many admirable features.

The latest improvement of the "Columbia" is a removable pen arm which makes chart changing easy. Have you heard about it? If you are thinking about installing a Recording Gauge, before buying get acquainted with the

"Columbia" Recording Gauge

Write for handsome catalog W-100 and sample charts



The Schaeffer & Budenberg Mfg. Co.

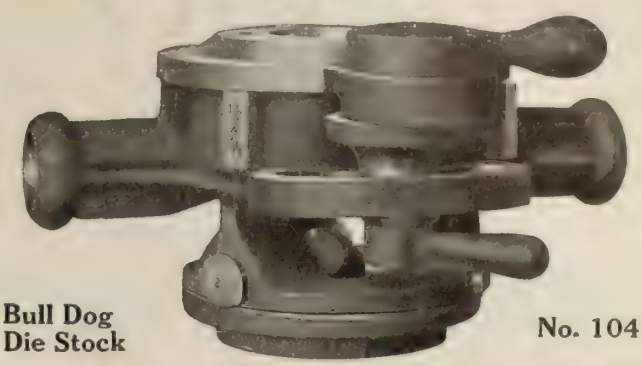
Brooklyn, N.Y.

Chicago Pittsburgh
New Orleans Washington
Atlanta

For any range of pressure or vacuum

Threads 8 Sizes of Pipe

¼", ⅜", ½", ¾", 1", 1¼", 1½", 2"



Bull Dog Die Stock **No. 104½**

Read the Oster Story

Twenty years' experience and careful study in the building of pipe-threading tools stands back of the Bull Dog Die-Stock No. 104-½, a tool of splendid usefulness in repair time. In point of time and money saved for you,

OSTER Pipe Threading Tool

No. 104½

pays. Together with its wide range of sizes No. 104-½ offers a surprisingly light weight and a simple, accurate operation. Change of dies is extremely easy. This tool, like all other Bull Dog Die-Stocks combines the Five Big Oster Features: 1 Self-locking Dies, 2 Self-locking guides, 3 No resetting, 4 No turning back over finished threads, and 5 No Bushing or breakable small parts. The "Bull Dog Tale" shown below contains an interesting and straightforward description of Bull Dog Tools. Use the coupon to-day and get your copy free by return mail.

The Oster Mfg. Co.

2099 East 61st Street,

Cleveland, Ohio

Supply houses in 22 Cities in Canada.

Kindly send me by return mail "The Bull Dog Tale"

Name .....

Address .....

City .....

State .....

(20)

The advertiser would like to know where you saw his advertisement—tell him.

MURPHY FURNACES

OCCASIONALLY we fail to get first contract; WHEN GET FIRST CONTRACT it is in but RARE INSTANCES WHEN DO NOT GET REPEAT ORDER—when additions are made to plant.

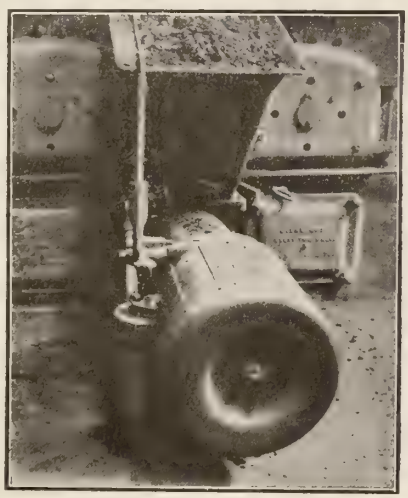
Illustrative of this: THE ST. LAWRENCE STARCH CO., Limited, Port Credit, Ont., bought Murphy Furnaces as follows:

1st order	March 1908	3 furnaces, 645 h.p.
2nd "	Feb. 1910	1 furnace, 215 h.p.
3rd "	June 1913	4 furnaces, 600 h.p.
3 contracts—in 5 years:		8 furnaces, 1460 h.p.

REPEAT ORDERS are the best evidence of merit!

For printed matter address:

MURPHY IRON WORKS, DETROIT, MICH. BUFFALO, N. Y.



JONES STOKERS
are Cutting Down Coal Bills

Your coal bill is your biggest single item of expense in the steam plant, whether large or small. A small saving on it will pay a good dividend on the investment, which makes the saving possible. The Jones Stoker actual cut in the coal bill is from 15 to 20 per cent. over previous hand-fired methods.

In short, no matter what the angle from which you look at it, no matter what the size of your plant, it has been positively proven that **JONES STOKERS will cut down your coal bill.**

Dress the idea up in whatever words you will — consider it from the point of **complete combustion, smokelessness,** or **automatic control of air and coal, a cut in your coal bill** is the sum total.

Think it over, Mr. Engineer; they're doing it in so many plants.

JONES UNDERFEED STOKER CO., Limited

National Trust Building, TORONTO, Ontario

The advertiser would like to know where you saw his advertisement—tell him.

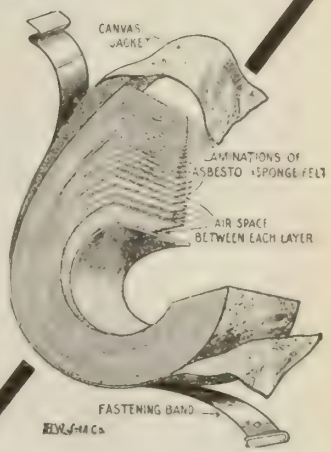
Shows Over $1800.00 Annual Saving

Before covering the steam pipes of their Central Power Plant with J-M Asbesto-Sponge Felted Pipe Covering, the Elkins Coal & Coke Co., Morgantown, W. Va., claim that the fuel consumed by the boilers in operating their plant cost them 4.4 cents for every ton of coal mined. A careful check by them after J-M Covering was installed showed that the fuel consumed in mining a ton of coal cost but 3.1 cents per ton, or a *saving of* 1.3 *cents per ton on every ton mined.* On this basis, J-M Asbesto-Sponge Felted Covering saves them over $1,843.00 per year, so that it paid for itself in less than six months and now continues to earn an annual dividend equal to 230 per cent. This is but one of many similar tests, showing that a great saving in fuel can be effected by covering steam pipes with

J-M ASBESTO-SPONGE FELTED PIPE COVERING

The secret of the remarkable insulating value of this covering lies in its construction. It is made of many layers of strong felt, composed of the best quality asbestos fibre, and fine particles of sponge, formed like the leaves of a book (see illustration), and confines such a vast amount of dead air that its insulating efficiency is almost 100 per cent.

Pipes insulated with J-M Asbesto-Sponge Felted Covering will carry steam over a mile with practically no loss. And unlike ordinary pipe coverings, vibration and rough usage will not cause it to crack, break or crumble, and thereby lose its insulating value. For durability and long service it is unequalled. Has been found in perfect condition after more than fifteen years' service on underground pipes.

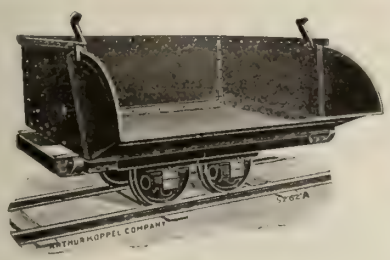


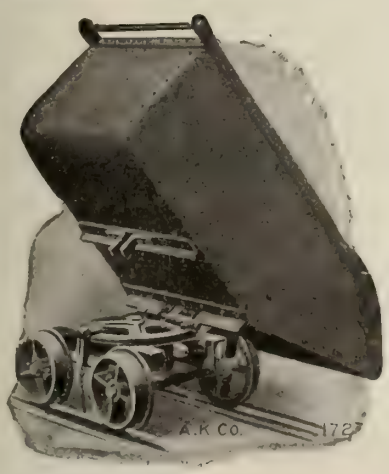
Write Nearest Branch for Sample and Catalog No. 100.

THE CANADIAN H. W. JOHNS-MANVILLE CO., LTD.

Toronto Montreal Winnipeg Vancouver

1332





A VERY satisfactory type of car for use in hauling ashes, dirt, etc., is the Scoop Car, which can be dumped either between the rails or to either side. Standard capacities are 12, 18 or 27 cubic feet for gauges of 18 or 24 inches.

How to Charge Furnaces Economically

A very important factor in the problem of keeping a constant supply of power is that of how to stoke furnaces efficiently. We are selling agents for a system of conveying coal and for charging furnaces in boiler rooms which requires very little labor and is practically indestructible. This system consists of the well known Koppel Cast Plate Track and Charging Cars.

ORENSTEIN-ARTHUR KOPPEL

Coal Charging Cars for the conveying of coal to boiler rooms are made of steel and are very durable. They are light in weight and easy and convenient to operate, being designed with special reference to boiler room service. The height of the cars is such as to make shoveling very convenient for the stoker. They may be supplied either with two side doors or end doors, as desired, and with or without swiveling base.

The rails of the track used in our boiler room systems are cast integrally with solid sectional plates, which provide a level surface to walk upon while car is being propelled.

We have a very interesting catalogue on this subject, showing many installations of the Koppel System, together with illustrations of cars, track, switches, turntables, etc., which we should like to send you. Ask for catalogue 412.

SALES AGENTS

The Canadian Fairbanks-Morse Co., Limited

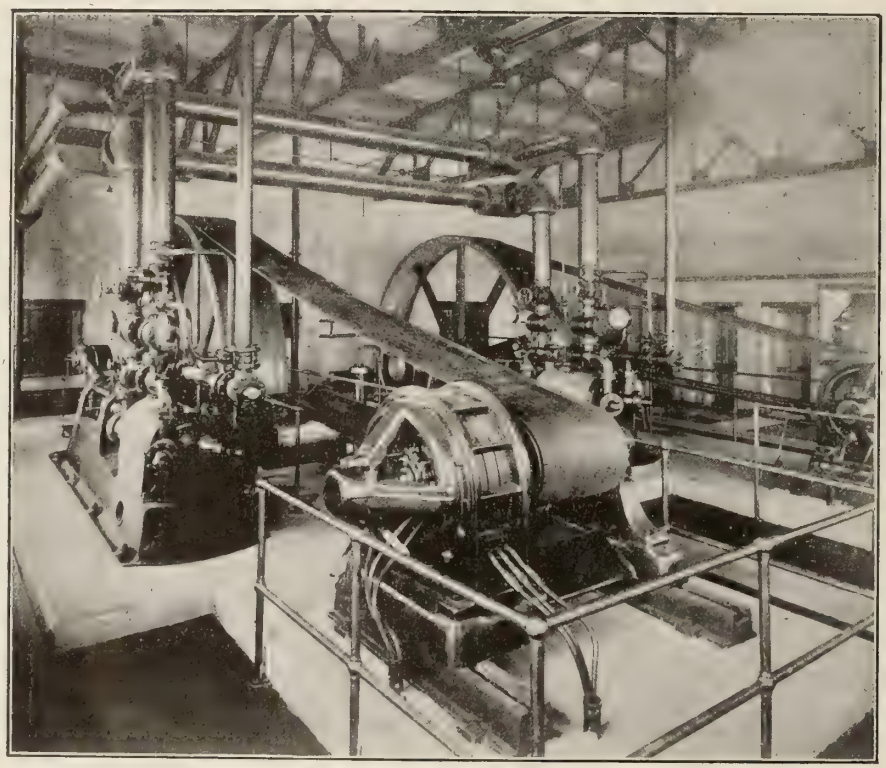
ST. JOHN QUEBEC OTTAWA MONTREAL
TORONTO WINNIPEG SASKATOON CALGARY VANCOUVER

"THE LINDE"

REFRIGERATING and ICE-MAKING MACHINERY

CORK INSULATION

Over 8,000 Machines in use. Established and Manufacturing in Canada for 16 years.



Two 100-ton "Linde" Belt Drivers, Double Acting, Horizontal Ammonia Compressors Manufactured and Installed by us in Canada.

Recent Orders:—

McDONAGH & SHEA, Winnipeg, Man.

O. LECLAIR, Ottawa.

MUNICIPAL HOSPITALS, Winnipeg, Man.

CANADIAN NATIONAL EXHIBITION, Toronto, Ont.

C.P.R. VANCOUVER HOTEL, Vancouver, B.C.

C.P.R. CALGARY HOTEL, Calgary, Alta.

SWIFT CANADIAN CO., Montreal, Que. (2nd plant).

McGILL UNIVERSITY, Montreal, Que.

OTTAWA UNIVERSITY, Ottawa.

MR. J. A. PATRICK, Westminster Hockey Arena.

O. LESAGE, Montreal, Que.

AND MANY OTHERS.

The Linde Canadian Refrigeration Co.,

Limited

37 ST. PETER STREET, MONTREAL

Branch Offices—Toronto, 28 Front St. East; Winnipeg, 909½ Main St.; Vancouver, 42 Inns of Court Building; Edmonton, Walker & Barnes, 562 Second Street; Calgary, General Supplies, Limited, 1233 2nd St. East.

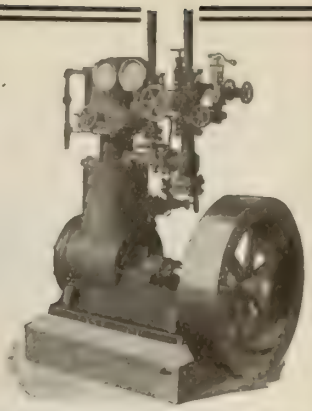
The advertiser would like to know where you saw his advertisement—tell him.

ESTABLISHED 1867.

THE VILTER MANUFACTURING CO.

242 BECHER ST., MILWAUKEE, WIS., U.S.A.

A small machine for small Ice-making and Refrigerating Plants, as well constructed and as successful in operation as larger outfits. VERTICAL SINGLE-ACTING AMMONIA COMPRESSORS, different sizes. Built with fewest possible number of parts. Sold at low price. Excels all others of like size in every point—simplicity, efficiency, reliability, smoothness of action, etc. We build horizontal and vertical ICE-MAKING AND REFRIGERATING MACHINERY, a full line of CORLISS ENGINES, and MACHINERY FOR BREWERS AND BOTTLERS. Our plant covers more than eight acres of ground.



Vertical Single-Acting Ammonia Compressor, Enclosed Type for Belt-drive.

The LINDE BRITISH Refrigeration Co. Limited

¶ Numerous fully authenticated laboratory tests organized from time to time in America and Europe, have invariably served to demonstrate in an unanswerable manner, the very remarkable degree of mechanical efficiency to which our products have been brought. ***The history of mechanical refrigeration is our history.***

Head Office: LONDON, ENG.

BIRMINGHAM	GLASGOW	JOHANNESBURG, S.A.
BRISTOL	BOMBAY	SYDNEY, N.S.W.
LIVERPOOL	CALCUTTA	PORT NAPIER, N.Z.

CANADIAN OFFICES
CORISTINE BLDG
MONTREAL

Self-Lubricating

In Cans
6, 12, 25 and 50 lbs.

SAFETY PLASTIC
METALLIC PACKING

FOR STEAM, WATER, AIR, GAS, ETC.
LASTS FOR YEARS AND NEVER WEARS THE PISTON ROD.

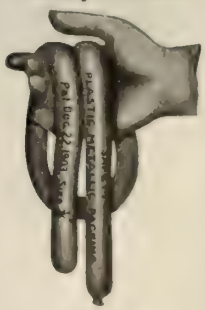
Guaranteed to stand steam temperature up to 550 degrees Fahr.
Guaranteed to stand hydraulic pressure to 5,000 pounds per square inch.
Packing furnished in bulk and in thin Cotton Tubes, sizes 3-16 to 1½ inch, 36 inches long, or in special lengths to fit your stuffing boxes.
Empty Cotton Tubing in assorted sizes FREE OF CHARGE with orders for the packing in bulk form.
The tubes are easily filled and they save you the expense of carrying a large stock of packings in different sizes.

Send for FREE SAMPLE and particulars.

Manufactured only by

STEEL MILL PACKING CO., WINDSOR, ONT.

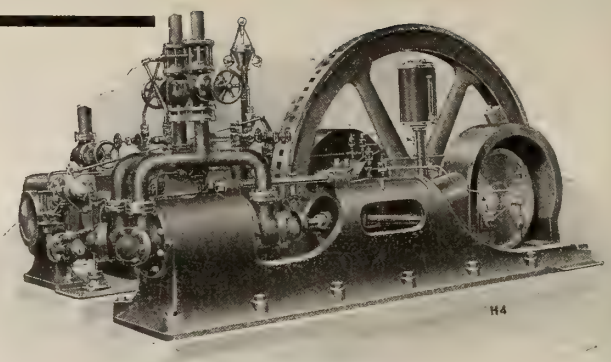
Practically Frictionless



Any Quantity sent on APPROVAL

The advertiser would like to know where you saw his advertisement—tell him.

FRICK



Refrigerating and Ice-Making Machinery and Equipment

is acknowledged the world over to have attained the highest degree of efficiency. For thirty-three years FRICK Machines have successfully endured the wear of exhaustive tests and proven all guarantees made.

It will pay YOU to KNOW US.

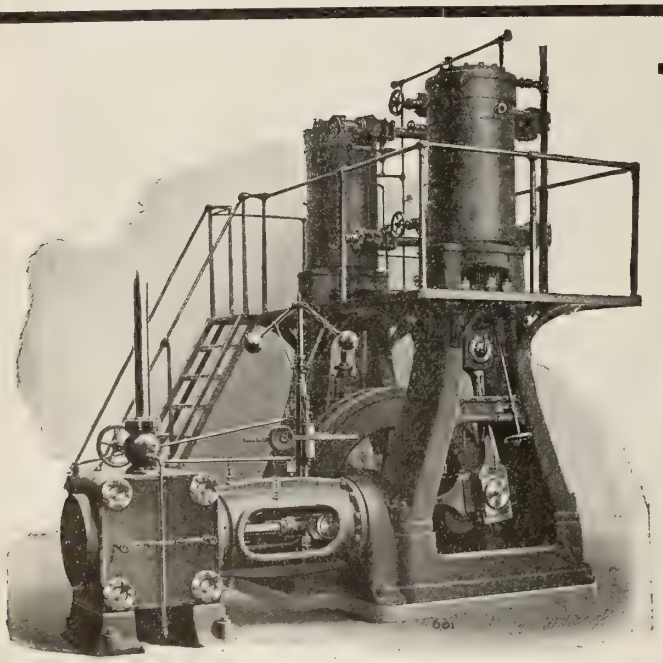
The FRICK is the only machine of which it can be said "There is no better machine built." The FRICK is durable—efficient and will last a lifetime.

We build all types of Refrigerating Machines—Vertical Single-acting, Horizontal Double-acting and Absorption.

WRITE FOR CATALOGUE TO

FRICK COMPANY, - Waynesboro, Pa., U.S.A.

NEW YORK CHICAGO SEATTLE PITTSBURGH CLEVELAND LOS ANGELES
ST. LOUIS DALLAS ATLANTA BALTIMORE BOSTON



Good Management Demands the Best

YORK REFRIGERATING MACHINES

Stand for

Efficiency Durability Economy

This is evidenced by the fact that many of the principal ice-making and cold storage plants are equipped with YORK Refrigerating machinery and apparatus.

The new fish freezing and storage plant just completed by the North Atlantic Fisheries, Port Hawkesbury, Nova Scotia, is equipped with York Machines and Refrigerating Apparatus.

For a plant requiring economy in operation, efficiency in power consumption and durability under hard service—install the YORK.

YORK MANUFACTURING COMPANY

Largest Manufacturers of Ice Making and Refrigerating Machinery in the World

Main Office and Works: YORK, Pa., U.S.A.

Represented in the Dominion by CANADIAN ICE MACHINE COMPANY

TORONTO, 163-167 Yonge Street **WINNIPEG, P.O. Box 336**

J. V. Jamison, President. T. B. South, Vice-President. J. V. Jamison, Jr., Treasurer.

THIS IS A CONTRACT

Looks Fair to Us. It is Fair

We invite users of Refrigerator Doors and Windows who are contemplating erection or remodeling plants to write us for

Sample Refrigerator Door and Frame Complete

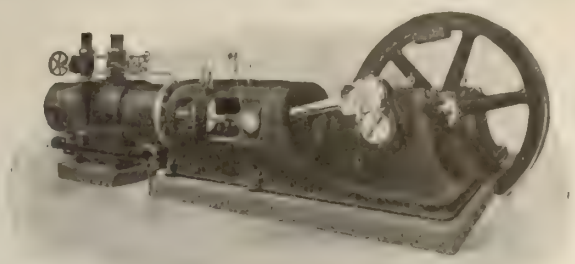
We will forward it to size required. If it is not satisfactory from every standpoint to *you* in style, workmanship, efficiency and plan, it is your property without charge or any obligation to us whatever. We feel justified in making the above offer, to show our foreign friends our good faith. We have no Agents, either here or in your great country, to exhibit and present our products. In this proposition we hope to prove that we merit your confidence.

Our patronage in Canada is very large and general. A few of the largest sales are to: —

Linde Canadian Refrig. Co.	Montreal, Can.
P. Burns & Co.	Calgary, Alta.
Swift Canadian Co.	Toronto, Ont.
Whyte Packing Co.	Brockville, Can.
Moose Jaw Cold Storage Co.	Moose Jaw, Sask.
Standard Milk Co.	Vancouver, B.C.
Edmonton City Dairy Co.	Edmonton, Alta.
Canadian Fish & C. S. Co.	Prince Rupert, B.C.

Jones Cold Store Door Co.

HAGERSTOWN, MD. U. S. A.



Arctic Electrically Driven

Ice plants are producing pure, crystal ice in cans, at a decreased cost for power and labor, and making a finer quality ice than the distilled water product.

This result is accomplished by installing our

Raw Water Ice Making Equipment

using the Arctic-Pownall System.

Any cheap motive power, such as water power, oil or gas engine, or electricity may be used.

Full particulars and printed matter will be mailed you — simply write us saying you are interested.

"We do it Right."

THE ARCTIC ICE MACHINE CO.

CANTON, OHIO, U.S.A.

Ice and Refrigerating Machines

THE COMING AMMONIA COMPRESSOR

THE "SAFETY"

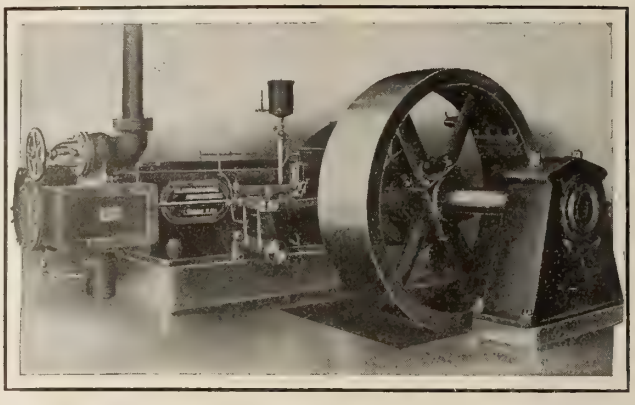
Built by

The HUETTEMAN & CRAMER CO.

DETROIT, MICH.

Complete Ice Making and Refrigerating Plants for every conceivable purpose.

SIX OF THESE "SAFETY" INSTALLATIONS TO DATE IN ONTARIO THIS SEASON



Side Crank Leonard Automatic Engines

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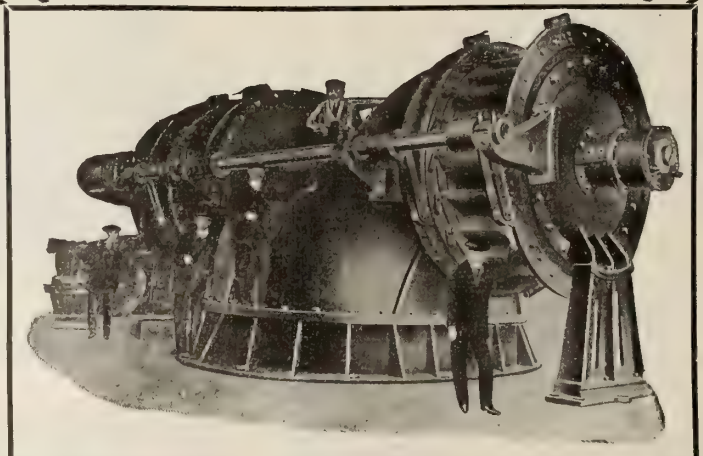

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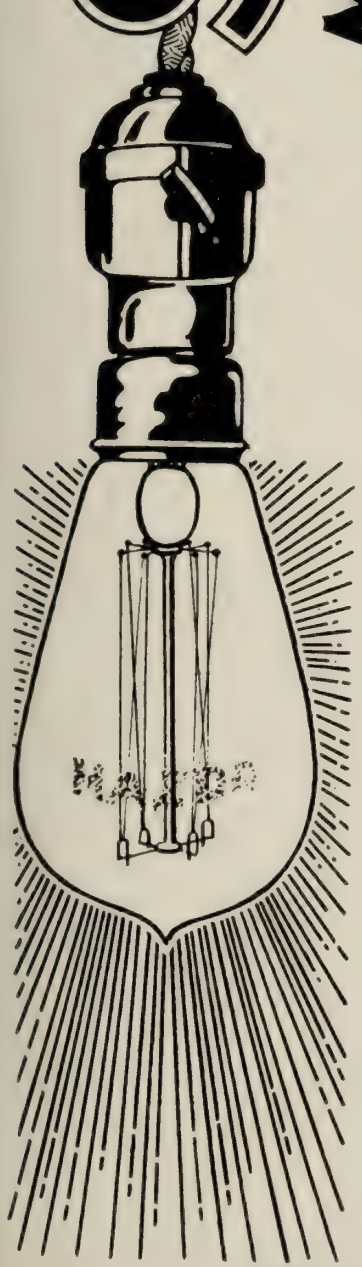

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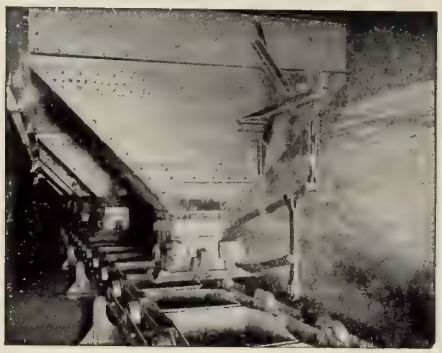

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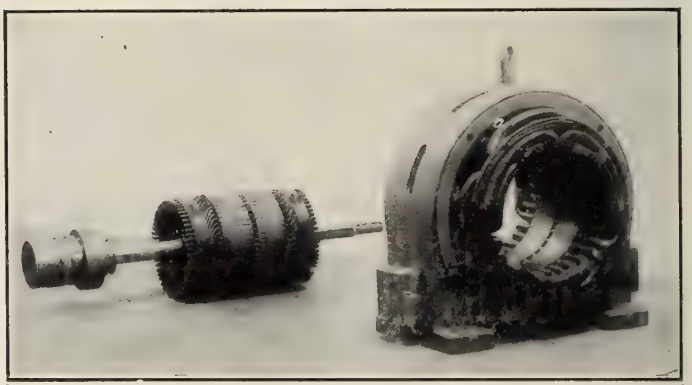

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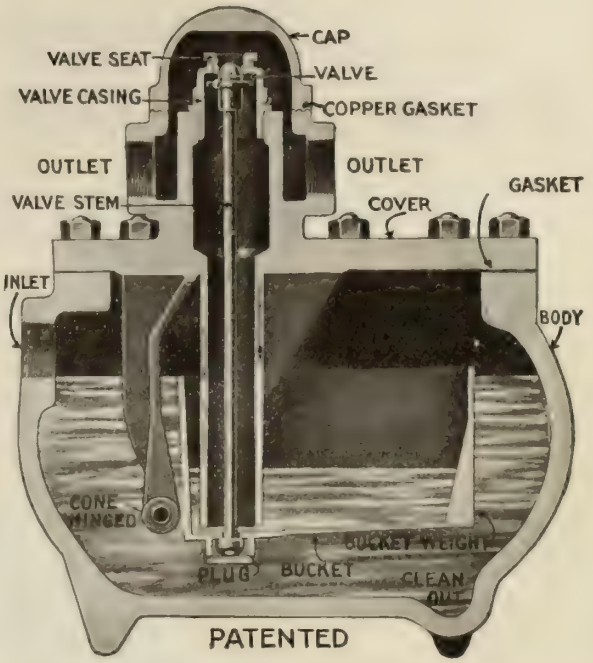

The *Squires Traps* give an intermittent discharge through a wide open valve, which assists in drawing the water to the trap and removing the water of condensation from steam pipes, steam separators, heaters, coils, stills, engine cylinders, receivers, etc. The valve is either tightly closed or wide open, thus eliminating the wire-drawing on the valve and seat. As soon as sufficient water enters the trap, the bucket, being buoyant, rises and closes the valve which is attached to it by a brass rod. When the condensation in the trap body has reached the high water line the bucket fills and sinks. The pressure at the trap then discharges the water in the bucket together with the condensation in the trap body through the valve port to the outlet until it has reached the low water line.

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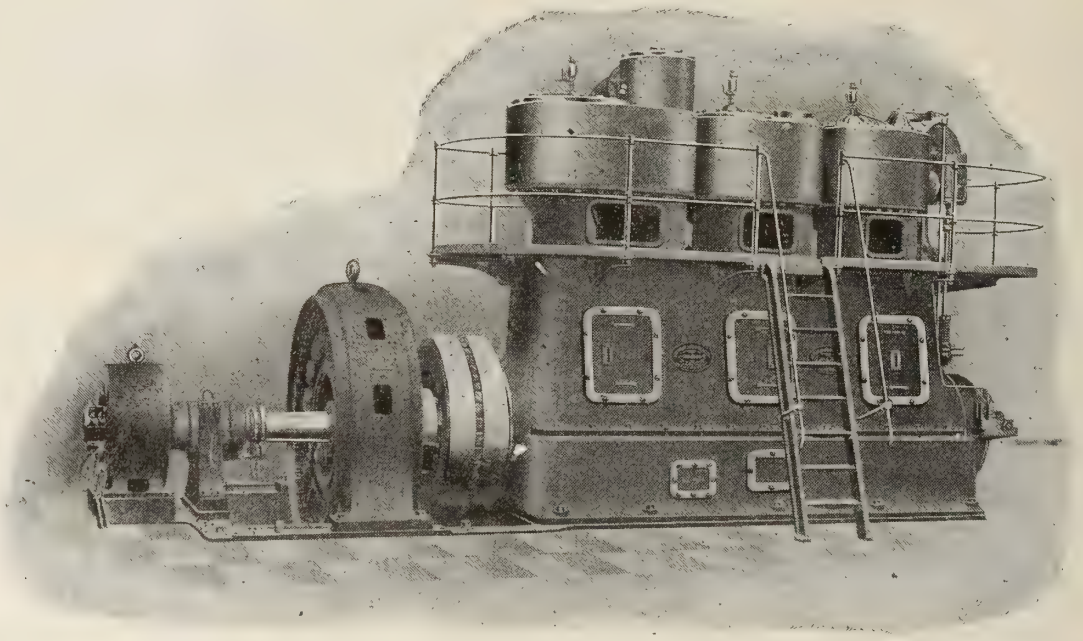
These engines have established a high reputation in electric light and tramway plants, collieries, cotton and paper mills, steel and iron works, etc., and are made in five different styles to suit steam pressure and working conditions.



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ENGINEERS AND BUILDERS OF

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Suitable for low heads and up to 1,800 feet.
Constant power, constant speed, with
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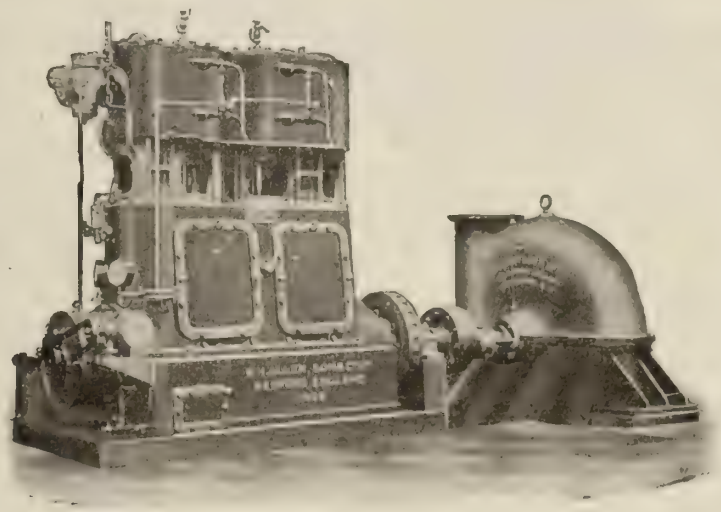

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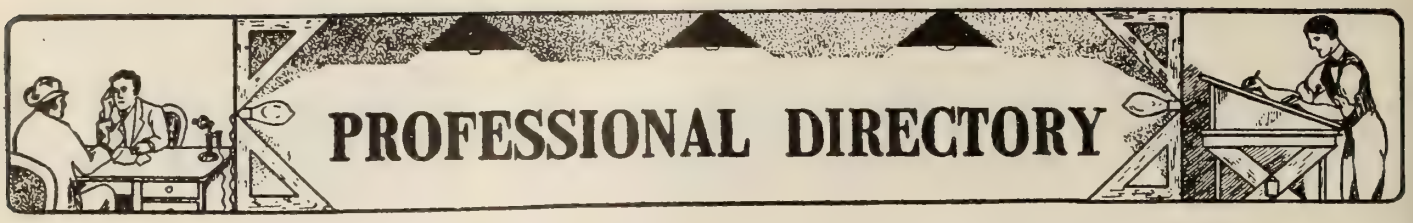

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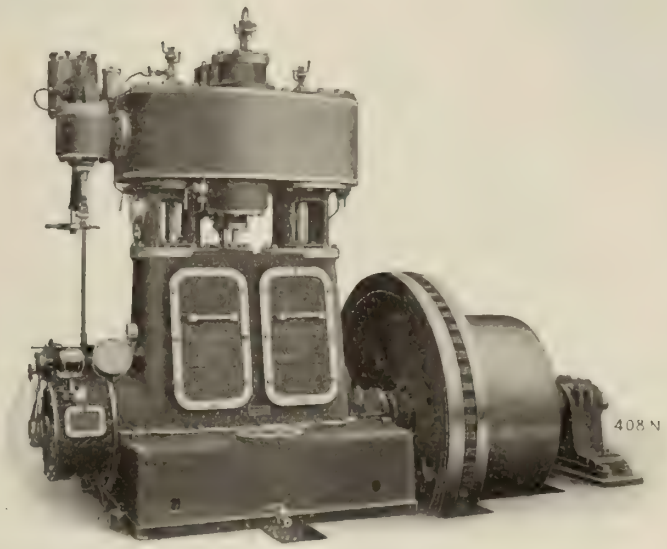
Quick Revolution Engines

Imitated but Never Equalled for Economy and Class of Manufacture

Note the Finish, Which Shows the High Class of Workmanship



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Automatic Expansion Gear Fitted to these Engines When Required

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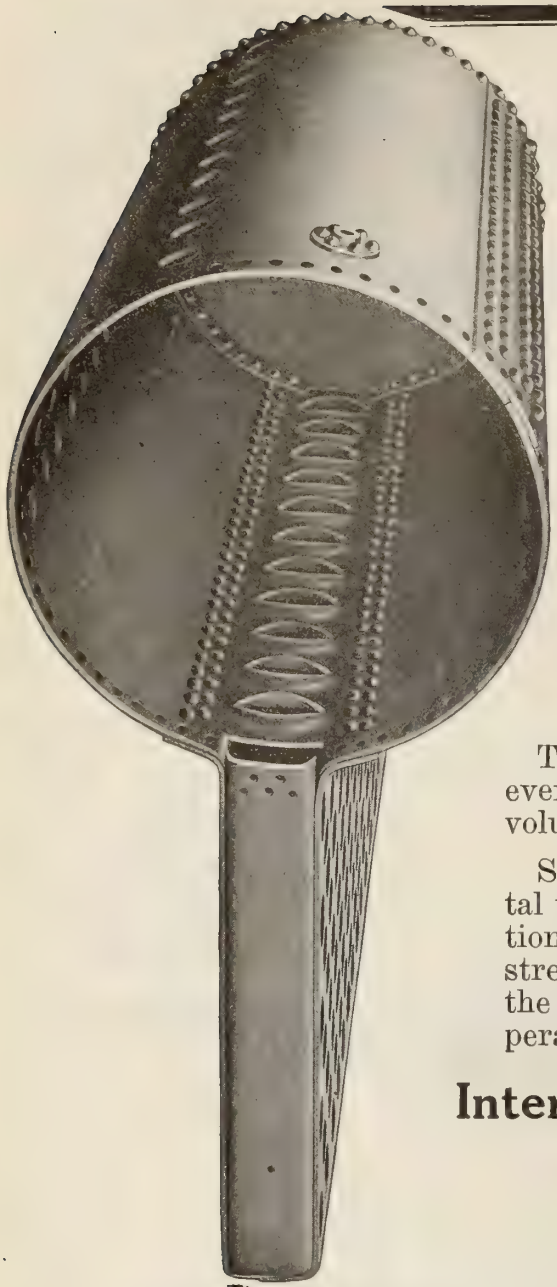

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The cross drums permit making an ample area at every point for the passage of water, or the much larger volume of water and steam.

Superheating tubes at the top, and straight horizontal water tubes at the water line complete the circulation. The water must move steadily in uninterrupted streams with perfect conditions for the absorption of the maximum amount of heat and for uniform temperature throughout.

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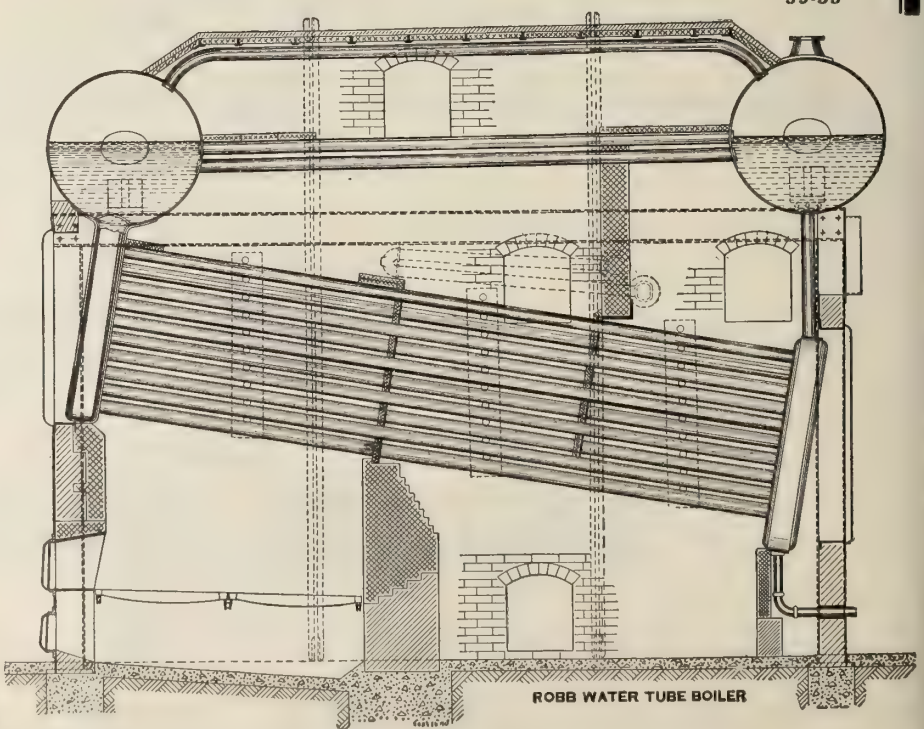

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Declaration of Principles

By the Business Press of America

THE Federation of Trade Press Associations in the United States in Eighth Annual Convention assembled at the Hotel Astor, New York, September the 19th, 1913, made the following Declaration of Principles:

1. We believe the basic principle on which every trade paper should build is SERVICE—service to readers and service to advertisers, in a way to promote the welfare of the general public.

2. We believe in TRUTH as applied to the editorial, news and advertising columns.

3. We believe in the utmost frankness regarding circulation.

4. We believe the highest efficiency of the Business Press of America can be secured through CIRCULATIONS OF QUALITY rather than of Quantity—that character, and not mere numbers, should be the criterion by which the value of a publication should be judged.

5. We believe in CO-OPERATION with all those movements in the advertising, printing, publishing and merchandising fields which make for business and social betterment.

6. We believe that the best interests of manufacturers, the Business Press and consumers can be advanced through a greater interchange of facts regarding merchandise and merchandising and to this end invite co-operation by manufacturers and consumers.

7. We believe that the logical medium to carry the message of the manufacturer directly to the distributor and the user is the Business Press.

8. We believe that while many advertising campaigns may profitably employ newspapers, magazines, outdoor display, etc., no well rounded campaign seeking to interest the consumer or user is complete without the Business Press.

9. We believe in co-operating with all interests which are engaged in creative advertising work.

10. We believe that business papers can best serve their trades, industries or professions by being leaders of thought; by keeping their editorial columns independent of the counting room, unbiased and unafraid; by keeping their news columns free from paid reading notices and puffery of all kinds; by refusing to print any advertisement which is mis-leading or which does not measure up to the highest standards of business integrity.

* * * * * * * * * * * * * * *

These principles, lofty though they may seem, have constituted our platform for years. We preach them and try to practice them.

And you will find, as many successful manufacturers have found, that consistent and persistent advertising in a journal that is run according to the above principles cannot be anything but an unqualified success.

Rate Card and full information gladly furnished.

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A Monthly Publication Devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power

143 University Avenue, TORONTO

G. & McC. VERTICAL QUICK REVOLUTION STEAM ENGINES

Will give you as they are giving others wherever installed

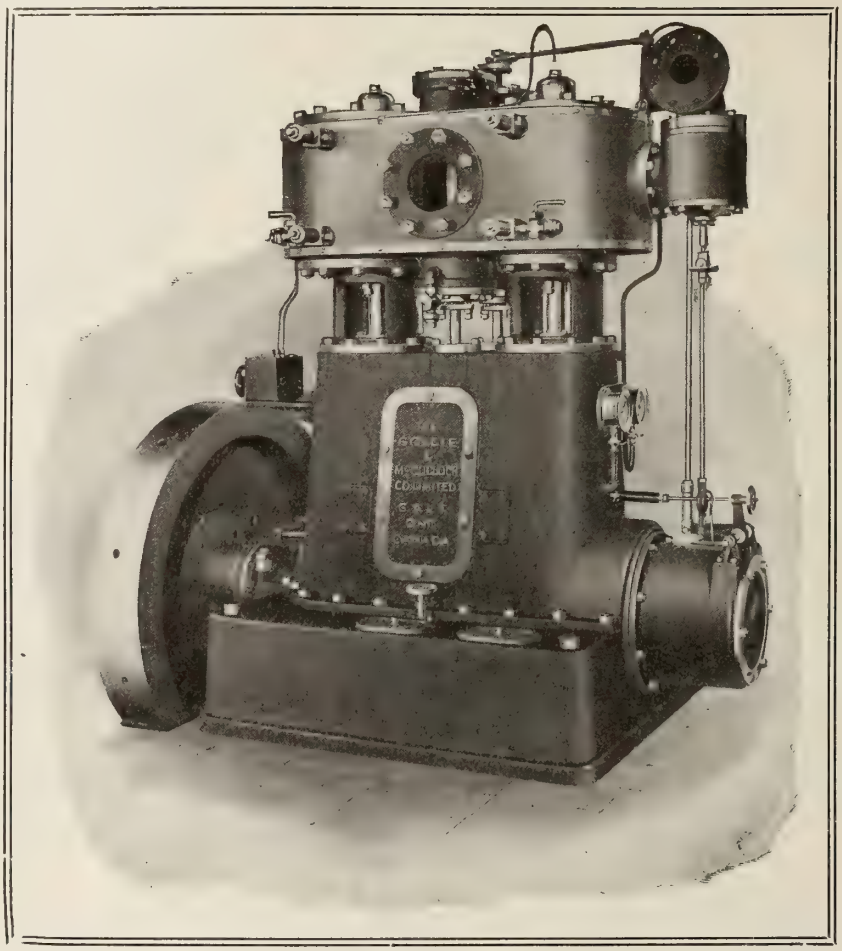
A MAXIMUM OF SERVICE

At a Minimum Cost of Upkeep

These Engines have a Perfect System of forced Lubrication.

They require little or no attention while running.

Built in all types and sizes.



They run with Practically no Noise or Vibration.

All working parts are very easy of Access.

Built to suit your Particular Requirements.

Two Cylinder Compound, Vertical Forced Lubrication, Quick Revolution Steam Engine, with Combined Throttle and Expansion Governor.

All the materials used in the Manufacture of Vertical, Quick Revolution Engines must be the best obtainable. In the construction of our Engines particular attention has been paid to this feature; the materials supplied being in accordance with **British Admiralty Specifications.** All Engines are tested under steam before leaving our works.

We shall be pleased to furnish Specifications and further information.

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The Question of Uniform Steam Boiler Specifications*

By T. E. Durban**

Needless to say we are in hearty sympathy with the views expressed and the recommendations suggested by the author of this paper, and while the primary application of the subject belongs to United States Boiler Practice, there exists in Canada an equal lack of uniformity in Boiler Regulations, and an equally pressing need of reformation.

THE possibility of uniform specifications for boilers is beset with many difficulties. However, I feel that the chief difficulty has been overcome, and that united action among boiler makers will bring about the much desired uniform specifications. I think that we all have been responsible to some degree for not having a uniform specification, owing to the fact that we have been consumed with petty jealousies, each of the other. Our endeavor to get slight advantages by making changes in specifications, in order to get business, has retarded the progress of such a specification.

While we would all unite in a general way in singing the praises of the uniform specification, we did not exercise any degree of sincerity in our attempt to get to the bottom of the proposition. Now that various States and cities have taken up the matter, and prohibited the common practice of salesmen cutting specifications and making changes in order to get business, it is the belief that we will have closer co-operation among the manufacturers of boilers, to the end that we will all figure on the same thing. Now that we are united, and all see the advantages of the uniform specification, our chief trouble, we believe, is over.

Standard Specification Long Desired.

The standard specification has for many years been the desire of the company that I represent, and we have been working consistently to that end. About 10 years ago we addressed a letter to all boiler makers in the United States, trying to get some concerted action. The replies that we received were most agreable, but the action was not there. We took the matter up with our Congressmen and Senators, and finally, during the occupancy of that office by Mr. Taft, with the President of the United States, pointing out to him the necessities of a standard specification from the public's viewpoint; citing to him that the United States exercised jurisdiction over boilers on navigable waters in order that it might protect, as far as possible, the lives and property of people who used these waters as a means of transportation, and citing to him that life was not less dear to the man who lived on land and pursued his occupation on the land, than the man who traveled on the water, and pursued his occupation on the water. However, we ran across the unsurmountable barrier of State's rights, when we urged the necessity of a common law governing the building of boilers. In spite of any argument that we could bring about, we landed always in the same place. Our Congressman would have been glad to have introduced a national law, but after consultation with the President, decided with him that it was absolutely useless.

In spite of this, however, a law was passed governing locomotive boilers as used on railroads. This was cited as a reason why there should be a universal law governing all boilers, but as a matter of fact it was also pointed out that a national law was possible in this case because of the fact that these boilers were engaged in Interstate trade. There was a time when locomotives could have been and were halted at the threshold of a State and not allowed to cross the line, due to great variations of laws of construction of boilers.

Existing Conditions a Great Factor.

Now, fortunately, due to various causes, it has become manifest that boilers must be built better and nearer to a common standard than ever before. The large number of laws has made it almost imperative that a man who is engaged in the manufacture of boilers for distribution should throw his whole energy into having the law so constructed that he does not have to carry a stock of material and stock of boilers on hand to meet the requirements of the various laws in the various States, Provinces and cities.

These laws, varying as they do, now from the other, make a needless waste, and as the cry of the country now is for conservation and economy, we think that this argument can be well used with the law makers of all the States and Provinces, who will take the subject up. The waste comes from the fact that a manufacturer is now almost compelled to build each boiler to meet the requirements of each law, necessitating slow progress through the shop, and enormous investment in material. The further fact that different manufacturers put different interpretations on the laws brings about a great conflict in the price of boilers.

With a uniform law and the co-operation of all manufacturers, these differences would be largely overcome. so that the boiler would reach the consumer, not only a better boiler, but for less money. Not only would the manufacturer be able to produce the goods and sell them for less money, and be more certain of his profit, but he would eliminate the probability of a large loss in case his foreman or designing engineer should get confused in the various laws. I think there is no concern manufacturing boilers that has not suffered from the lack of uniformity in provincial or city laws, and of those engaged in making various types of boilers for distribution throughout the entire country, I venture the assertion that there is no one that has not met with very considerable loss. All this can be eliminated; the public can be protected, both as to its life and its investment and the manufacturer can make more money on less investment, if we can succeed in getting concurrent legislation, or approximately concurrent legislation, in various provinces.

Concurrent Legislation Needed.

We are fully alive to the fact that no problem that has ever faced the Canadian or American people has been more discussed than concurrent legislation. The different laws in different provinces tremendously embarrass manufacturers doing interprovincial trade, and they affect our social relations. We know the action that has been put forth to have uniform marriage and divorce laws uniform laws for crime and on credit, and on other matters too numerous to mention, but we believe no subject for concurrent legislation has been broached by people who have been so unitedly combined as to what was required as this problem that we have. There is no doubt in the writer's mind that a conscientious effort on a specification upon which we have all united will influence the law makers in a great number of States who have not yet passed a law, and in turn will influence the laws already on the statute books to such an extent that corrections will be made in them to make them conform to a standard which we can and will ultimately adopt.

It seems to me beyond doubt that a concurrent effort among the manufactur-

*From a paper read before the Boiler Manufacturers' Association Convention in Cleveland, Ohio.

**General Manager, Erie City Ironworks, Erie, Pa.

ers of boilers and mechanical engineers and users of boilers cannot help but bring approximately concurrent legislation. As it is now, the laws are confusing in the extreme, and it requires the undivided attention of a bright mind to so issue the orders to the shop that the boilers will come through without trouble.

Diversity of Boiler Laws.

Boiler laws are coming out from the East, West, North and South—in every direction. Not only are the laws themselves different, but a different interpretation has been put upon the same law by different inspectors and different builders. I presume without exaggeration that there are at least 100 laws and changes to laws in the United States alone, governing the manufacture of our product, and this can be multiplied by a thousand times as many inspectors as there are laws.

Example.

We have asked a decision of one point —the butt strapping of drums. Our interpretation of the law as written in several of the States is that all butt strapped seams be made to a maximum length of 12 ft. We have been informed by some inspectors that this does not apply to water-tube boilers, and by other inspectors that it applies to all boilers. We conformed our specifications to meet the letter of the law; that is, to have no butt strapped seams over 12 ft. long, whereas we have found out since we put this order into effect in our works that many boilers or drums of boilers are being made and passed with butt strapped seams as long as 20 ft.

In spite of all this, we are thoroughly impressed that the boiler inspection laws have been and will be beneficial to all boiler manufacturers and all users, and that out of it will come the ideal boiler in design workmanship and material. This is a consummation to be desired; so that when we come to figure on a job we will be all put on the same basis, and it will be necessary for us to furnish a boiler that, in the estimation of all the law-makers, will be the best boiler made.

Boiler Laws Grouped.

The present laws as enacted have been of great benefit, as they have reduced what was formerly opinion, and frequently guess-work, to something definite and right. As we now have them, they have been classified by our engineers in three groups:

1.—The group comprising Massachusetts, Ohio, Detroit, Manila, Chicago and Indiana. Detroit, Ohio and Manila laws are practically identical. Massachusetts law differs somewhat, and the Chicago and Indiana laws are modifications.

2.—The group comprising all British specifications in which we are interested—British Columbia, Alberta, Saskatchewan and Ontario — which are all copies or modifications of the British Columbia law.

3.—The group comprising inspection laws of Philadelphia, Seattle, St. Louis, Los Angeles, Montana, New York and others. The laws of this group differ from each other, but in a general way are less complicated than those of the other groups.

Boiler Law Vagaries.

All the laws in the United States unite on a factor of safety of five. The Canadian laws require a factor of safety of five and a half to six and a half, and it is optional with the inspector what factor of safety he will accept, depending upon his opinion of the good workmanship that is done and upon just how the boiler happens to strike his fancy. The material for Massachuetts, Ohio, Detroit and Manila is special, both as to the chemical and physical properties. A certified mill test is required for all plate material, and the plates must be stamped in five different places. Other inspections require only a mill test, and are not so particular about the chemical analysis of the material.

We at one time had a boiler refused in Massachusetts, because the chemical analysis of sulphur was off one-thousandth of one per cent. We have coming through our shops, as we presume most of you have, boilers that come under almost all these laws, and the resulting confusion may be something stupendous, and must be taken care of in the price we make to the consumer on the boilers.

We have now established through the effort of the steel manufacturers, a standard specification on steel, and by common consent we have established the efficiency of certain seams, and also a certain strength that can be allowed per inch of area on braces and stay bolts, so that it does not seem a far cry to get a definite specification on a boiler itself.

Problems to be Solved.

One problem that will confront us will be the variations in tensile strength which is standard with mill. A variation of from 56,000 to 62,000 lb. in tensile strength would make a considerable difference in the thickness of a plate. If one of us should figure on 56,000 and another on 62,000, necessarily one would be figuring on a thicker or thinner plate than the other. In a common specification it would be necessary to specify the material in the braces, and the working stress in pounds. Now it varies from 6,000 to 8,000. Unquestionably, all holes should be drilled from the solid, or punched ¼ in. small and reamed to size; that is, there should be at least a full quarter inch of reaming.

In Ohio, Detroit and Manila there is a uniformity in the number of braces above the tubes; there are no particular specifications as to tubes of the material in the tubes, but in almost all the specifications the tube holes must be either cut from the solid or punched ½ in. small and reamed to size.

The butt strapped seam is now demanded on all boilers, due to the fact that it has been proved to the satisfaction of many people that lap seams are a menace to the life of the boiler, and many boiler explosions have by experts been attributed to lap seams in the longitudinal section. Some laws limit the thickness of plate to ½ in. and therefore limit the pressure on horizontal tubular boilers.

We should strive in our uniform specification for a standard specification on material, so as to remove the necessity of carrying material in stock of two different physical and chemical qualities.

If this organization, through its various connections, can establish in each legislative assembly the necessity of uniform treatment of this subject, so that when laws of this kind are coming up they can bring to bear the influence of all interested people, as they easily can, by keeping in touch with the situation of the laws to be enacted, we can accomplish our purpose. Of course, it will be attended with much hard work and honest effort, but, now that we have at least reached an agreement that a standard specification is necessary, the greatest obstacle that has prevented us from having it heretofore, has been removed.

A Uniform Steel Specification.

A uniform steel specification seems to be very easily accomplished. By comparison with three mills, we find that there appears to be no necessity for special requirements such as Massachusetts and Ohio. We find that in the law requiring special steel there is practically no difference between fire box and flange steel on these special requirements, except as to the matter of the brand. Eighty-five per cent. of flange steel coming from one mill has all the qualifications and could be stamped as fire box, and in another mill 93 per cent. of all flange steel could be stamped fire box. That is, both steels have the same chemical and physical qualities and they are changed from flange to fire box, or from fire box to flange, by a stamp which is put on, the only difference being that the mills charge $2 a ton extra for using a stamp marked "Fire Box" as against a stamp that would brand it as "Flange Steel."

"We would suggest that what is really required is more stamps on the plate showing mill test, and less stamps showing the brand. If the mill test stamps are put on so that they can be observed

by the inspector, he can then get the full record of the plate from this heat and mill test stamp. He can also tell what the tensile strength is, and not assume it. As a matter of fact, all inspectors and all State laws will assume the minimum tensile strength the law permits, unless they have access to the physical test as made by the mill. There ought to be uniformity regarding this point.

Flange and Firebox Steel.

In these specifications, particularly of Massachusetts and Ohio, fire box steel is specified in the shell and flange steel in the heads. This, in our estimation, is an error. If there is a difference in the steel, and if the fire box steel is supposed to be of a better quality, attributable to its increased ductility, which would make it a better steel for flanging, the law is exactly contrary to the best practice in steel. The best steel should be used for flanging, and therefore the specifications and the law should read, according to our ideas, flange steel in the shell and fire box steel in the heads. As before stated, however, there is no difference in the quality of the steel, hence, we feel that the Massachusetts, Ohio and Detroit inspection laws calling for fire box steel in the shells is clearly in error, militating against people who buy boilers under those laws.

We doubt very much whether any State law would hold good, if it were tested, that specified a certain brand on the plate. We believe that any court would decide that if the plate came up to the physical and chemical test required by the law, it would make no difference what the plate was branded, and it might not be a bad idea for this organization to designate some manufacturer to ship a boiler into one of these States and have it branded "Flange Steel" and make a test case; of course, with the hypothesis that the flange steel passed the physical and chemical tests to entitle it to a brand of "Fire Box."

The boilers that the company I represent manufacture and whose specifications have been submitted, would pass any of the American laws except such laws as call for fire box steel. To a concern building an occasional boiler, and that does not have to carry material and finished boilers in stock, the difference in price of $2 a ton would not be material, but it is important with one that carries a large amount of stock and a large number of finished boilers, and uses from 10,000 to 12,000 tons of steel a year. It can be readily appreciated that it would cost from $20,000 to $24,000 a year to use flange and fire box steel, and it would necessitate carrying, in order to supply the trade promptly, double the amount of stock, both in the flange plate and in the finished boiler; all of which would have to be made up in the price charged to the consumer for the boiler.

Using Flange Steel Throughout.

Along the line of conservation and economy, would it not be wise to adopt flange steel for boilers throughout, for, as previously stated in this paper, there is no difference between flange and fire box steel from the majority of mills except the stamp? It is a direct discrimination against purchasers in various States where they have the law of fire box steel, causing them to pay more money for their boilers. In other words, is it not a fact that the people who reside in States that have not yet passed these laws will get a better boiler, or as good a boiler at least, for the same money, as a resident of a State who buys under the law providing for special steel? The man in the adjoining State would get steel of the same physical requirements and the same chemical analysis and he would get it for less money.

Again, some States require brackets on the boiler, while some States require the boiler to be suspended from a gallows frame. Will a gallows frame support a boiler any better in Indiana than it would in Massachusetts or will a boiler with brackets on stand any better in Massachusetts than it will stand in Indiana? All these things cause extra expense to the manufacturer, and make an extra price to the consumer, for which he gets no adequate return.

Recommendations.

In conclusion, we would recommend:

That boilers be built on a factor of safety of five, of uniform steel, and that this specification cover flange steel.

That the steel be marked with the heat number instead of the brand, and that it be made of minimum tensile strength of 60,000 lb., and be subject to the bending and quenching test, and that it have phosphorus not to exceed 0.03 per cent., sulphur not to exceed 0.04, and manganese 0.50.

That weldless crowfoot type braces be used, of the same quality of steel as the plate, that they be figured on a basis of 7,500 lb. per sq. in. of section in the brace, and that on this basis, no brace be used containing more than 1.28 in. area of section.

That through braces, either above or below the tubes be weldless, and be figured on 7,500 lb. per sq. in. of area.

That all seams be butt strapped with inside and outside covering strips.

That all manholes be 11 x 15 in.

That no plates be used in a tubular boiler thicker than $\frac{5}{8}$ in.

That all holes for rivets be punched $\frac{1}{4}$ in. small, and reamed to size.

That all flue holes be punched $\frac{1}{2}$ in. small and reamed to size.

That no cast iron be used in connection with the boiler, either for reinforcement or any other purpose.

That all plates be beveled on a planer instead of sheared on a bevel shear. A demonstration on a 9-16 in. plate shows that it is impossible to do a good job on a splitting shear, and that the same objection that exists to a punched hole holds good in the use of a splitting shear on thick plate; that is, the metal is distorted by use of a splitting shear.

That water column connections all be $1\frac{1}{4}$ in.

I would recommend, also, that a committee be appointed with power to bring together a committee of boiler makers, steel manufacturers, State and city officials, whether they be inspectors or chairman of the boards; a committee from the American Society of Mechanical Engineers, and a representative from the leading boiler insurance inspection companies; and that the meetings of this committee so appointed shall be open to the general public and that this be done within the next 60 days, in order that rules and regulations may be adopted that can be made uniform for the construction of tubular boilers.

I would also recommend that the utmost publicity be given in all the trade and mechanical papers to the efforts of manufacturers to procure a standard specification.

CONCERNING INTERNAL COMBUSTION ENGINES.

CARBON deposit in the cylinders and valves of internal combustion engines has always been one of the great disadvantages of this class of motive power, and this is emphasized in the case of the automobile motor because of the frequency with which it is necessary to take down cylinders and remove the valves.

A way of removing this deposit without the necessity of removing such parts has come recently into use. The apparatus employed consists of a tank of oxygen with appliances of such a nature that all parts of the motor can be reached after opening a valve cap or sometimes only a spark plug. When the nozzle is inserted in the opening, the carbon is ignited by means of a taper as soon as the gas is turned on. The deposit is burned away from the metal very rapidly, and, as soon as all the carbon is consumed, the combustion automatically ceases since the gas has had no effect after the cylinders and valves are clean. The metal parts, it is stated, are not affected, and only a few minutes are required to burn away all deposits even when very heavy.

Steam Boiler Explosion at City Gas Plant, Oshawa, Ont.

Some time ago we were asked why we did not publish editorial matter dealing with boiler explosions in Canada, and, in reply, had to make confession that it was entirely on account of the paucity of such occurrences. An opportunity is now afforded us, yet we trust that the explosion interval may continue to expand, thereby adding fresh laurels to our manufacturing ability, our operative care, and our inspection thoroughness.

ON Friday morning, September 12th, there occurred a disastrous boiler explosion in the plant of the City Gas Company, Oshawa, Ont., from which two men lost their lives, and considerable damage was done to the gas plant and buildings generally.

FIG. 1. TOP HALF OF BOILER SHELL BLOWN A DISTANCE OF 350 FEET.

The boiler referred to was of the return tubular type, 44 in. dia. by 11 ft. 6 in. long, and contained 40 3 in. tubes. The shell was made up of three courses of ¼ in. plate. The centre course consisted of four pieces, as seen from the photos, and the heads were 5-16 in. thick. The circumferential and longitudinal seams were lap and single riveted, using ⅝ in. rivets pitched 2 in. centres. Each head was braced by 3 diagonal stays made of iron and welded.

The stays were attached to the heads by double crow feet 3 in. x ½ in., and were secured to the head by 4 ⅝ in. rivets. The palm of stays, 2 in. x ½ in., were secured to shell by 2 ⅝ in. rivets.

The boiler was supported on brickwork by two cast iron brackets on each side, which were attached to shell by 6 ⅝ in. cap screws, with nuts on the inside. The front head of boiler was made up of four pieces, as seen from the photos.

The dome was 21 in. dia., 31 in. high, and the head was secured to sides by 3 ¾ in. stays. The neutral part under dome was cut away the full size of the latter.

History and Characteristics.

As to the history and characteristics of the exploded boiler, investigation went to show that it was forty years old, and had been in service in the gas plant about six years, being a second-hand boiler when installed. An examination of the exploded boiler showed cracks in many places. The plates were torn, and the joint left intact. The plates were badly laminated and crystallized, and, in fact, appeared to be completely worn out.

Coroner's Jury Finding.

(1)—That the deceased came to their death, caused by an explosion of a steam boiler, on September 12th, 1913, while at work on the premises and in the employ of the Oshawa City Gas Co., in Oshawa, Ont.

(2)—We are unable to say what caused the explosion, but from the evidence it appears that the water in the boiler was allowed to get too low at times, and that the boiler was subjected to extreme pressure.

(3)—We also believe that the man in charge had insufficient experience in the care of steam boilers.

(4)—We also believe there should be a better system of boiler inspection by thoroughly competent Government inspectors for all stationary boilers under the management of competent men when human life is at stake.

(5)—We also find from the evidence produced that the boiler, in our judgment, was old, unsafe, and unfit for the

FIG. 2. REAR HEAD AND DOME OF EXPLODED BOILER.

pressure and work for which it was employed.

Photo No. 1 shows the top half of shell, which was blown over the building and landed about 350 feet away. Note the elongated hole in sheet where the lug was blown out, also the number of pieces in centre course in shell. The lug blown out can be seen on ground in front of

FIG. 3. FRONT HEAD OF EXPLODED BOILER.

shell plates. The man standing to the left is D. M. Medcalf, Chief Inspector of Steam Boilers for the Province of Ontario, while the third man from left is T. J. Main, one of the Provincial Inspectors.

Photo No. 2 shows the rear head and dome of exploded boiler. Note the tubes ends in tube sheet, where they separated at the welds.

Photo No. 3 shows the front head. Note the repairs that had been made. and the manner in which the head had been blown to pieces.

Photo No. 4 shows the inside of the plates over the fire. Note the cracks on longitudinal seams.

THE SMOKE NUISANCE.

IN almost every city, especially where manufacturing industries are attended by large volumes of smoke, the problem of abating the so-called smoke nuisance has proved not easy of solution. In many of the methods used for clearing smoke, a "point" or "edge" electrical discharge is used. A discharge of this kind is not uniformly distributed about the point or edge. The discharges cause a slight pressure in the gas, and the smoke or fumes always seek that part of the apparatus where the discharge is weakest or entirely non-existent.

A writer in the Scientific American has made use of a corona type of discharge, and has thus obtained a perfect radial symmetry of the discharge about the electrode. The negative corona is found to be more suitable since slight changes in the position of the corona electrode do not greatly affect the symmetry of the electrical discharges. It is probable that this form of discharge is the most efficient application of the electrical method of removing fumes, smoke and dust from gases.

The use of 300 watts will clean 800 to 1,000 cubic feet of the densest kind of smoke or fumes per minute, with a very small energy loss. The cleaning can be done by passing the gases through 4 ft., or even less, of the corona discharge. The voltage is about 28,000.

BOILER BAGGING.

THE majority of the reported cases of boiler bagging are due to the presence of scale or oil in the boiler, states a writer in the "Power User." The removal of the former may be accomplished by what has been termed the "periodically clean" method—that is to say, by the use of mechanical cleaning methods each time the boiler is opened up for inspection, by the introduction of boiler compounds, or by treating the feed water chemically.

No amount of chemical treatment will remove oil from feed water, however, and some mechanical filtering process must be relied upon for its elimination. Some engineers favour cloth filters and some sawdust, sand or other substances; but most depends upon the design of the filter itself, and individual manufacturers of these apparatus may be relied upon to adopt the filtering medium which is best suited to their own construction.

With regard to the comparative harmful properties of various oils, the most dangerous bags and blisters are generally caused by animal and vegetable compounds, with or without the additional presence of scale. Attempts to boil them out with soda or some alkali are to be severely condemned as rendering the oils more dangerous still.

FIG. 4. INSIDE OF PLATES OVER FIRE ON EXPLODED BOILER.

Observations Concerning Current Gas Engine Practice*

By W. Fennell, M.I.E.E.

The author of this paper discusses in a clear and convincing manner the position of the gas engine as we find it to-day, and at the same time gives prominence to much valuable data, whereby those engaged in or about to engage in the manufacture of this power unit, large and small, may have imparted to them a clearer conception of successful product requirement.

I SHALL confine my remarks to engines of from 12 in. to 36 in. diameter pistons, or, in other words, to medium powers, such as would be met with in stations up to 3,000 kilowatt capacity. In the first place, I would divide the types into two and four cycle, and it must, I think, be admitted that at present the two-cycle engine is in the experimental stage. The two-cycle engine should be cheap, but it is not at present very much cheaper than the four-cycle. I think this is because no maker has succeeded in producing a commercial two-cycle engine without gas and air pumps. Motor car and other small engines have been so made, using the crankcase as the displacing cylinder, but one does not like to contemplate a back fire in a 500 h.p. crankcase.

Two-Cycle Engine Features.

The first advantage claimed for a two-cycle engine is the absence of exhaust valves. The piston on its outward path uncovers the exhaust ports, but much of the apparent advantage disappears when one has had experience with large exhaust valves. I think the question of exhaust valve leakages is unduly important in our minds. Every man who owns a motor car has valve leakages as a nightmare. In large engines, the valves do not need much grinding in, as a slight leak is not serious. The volume of charge is so great that only a small percentage can escape even if the valve "fits where it touches." I should not, therefore, give much heed to absence of exhaust or of inlet valves and the troubles with them, unless convinced that there would be less trouble with gas and air pumps and their valves. I should also ask for proof that the two-cycle engine is cheaper to run than the four-cycle, taking interest and depreciation, fuel cost, lubrication and repairs.

Another point to consider is heating—there are, other things being the same, twice as many explosions as with four-cycle. This means that for a given cylinder area and piston speed we have to get rid of twice as much heat. Are we able to do it without overheating or without excessive casting strains? What value the exhaust and suction strokes on a four-cycle engine have in preserving lubrication, and in reducing skin temperatures of cylinders and piston rings can only be surmised until we have more experience of large two-cycle engines running without these two "idle strokes."

With regard to mechanical efficiency this should be to the credit of the two-cycle if the inefficiency of the pumps does not destroy it. The effect on economy is, therefore, rather involved—we know that the power output is increased for the same cylinder volume, and we must set the undoubted economy against the loss due to part of the charge getting away at a time of exhaust and admission. The following are representative "best" figures for engines of 400 B.H.P.:—

4-cycle, 9,000 B.T.U.'s = 67 ft. of 135 B.T.U. producer gas per B.H.P. hour.

2-cycle, 10,500 B.T.U.'s=78 ft. of 135 B.T.U. producer gas per B.H.P. hour.

I look to the future of the two-cycle engine as being bright, but it will have a hard fight against the established position of the four-cycle engine.

Vertical v. Horizontal.

It is unfortunate that vertical engine makers will insist on running at high speeds—not high piston speeds, but high revolution. In all well-known types, we have to consider high speed vertical versus slow speed horizontal. This confuses the question, and is apt to mislead one. It is the old battle of the steam engine types over again, and the result may be the same. Just as the steam turbine came in and disposed of the question of steam engine types in large sizes, the gas turbine will possibly settle the question of vertical and horizontal gas engines.

The first engines were horizontal, and because there was trouble due to cylinder wear, some thought it was the weight of the piston which had something to do with it. A very elementary calculation shows, however, that the forces due to angularity of the connecting rod so greatly exceed the weight of the piston that the latter can be ignored. Vertical engines, being restricted in height by practical considerations, usually have shorter connecting rods than horizontal, so that the side thrust is greater. It is clear that gravity takes so little part in the question that whether you run an engine on its side or on its end or upside down, it makes little difference to piston and cylinder wear.

There is another and much more important cause of wear on the cylinder walls than weight, and perhaps even the thrust. If one imagines the piston a little smaller than the cylinder, and again, if one imagines that the piston rings do not fit very well, we get a space on the side opposite to the thrust, and in this space we get pressure approaching that of the explosion. A very slight consideration of the matter shows that we may get a very large force assisting the thrust. I have more than a suspicion that the idea of splash lubrication was the real inducement to the modern designer of vertical engines, both steam and gas, but splash lubrication is dead.

Vertical Engine Advantages.

There are one or two points in favor of the vertical engine, and these are questions of:—

(1)—Expansion.—The cylinder can be supported on one end, and so may grow vertically without restriction.

(2)—Lubrication.—The oil leaking from the little end and splashing from the big end will tend to run away from the cylinder and so restrict, and perhaps prevent, over-lubrication. The difficulty to-day is not to get enough oil, but to restrict it.

(3)—Small ground space occupied.

Vertical Engine Disadvantages.

The disadvantages of vertical engines are the necessity for restricting the dimensions of the crank chamber, due to considerations of strength, and consequently absence of room to get at the working parts; the fact that burnt oil and tar is constantly collecting on the piston head and is forced down between the piston and cylinder and behind the rings, and the temptation to high rotation speeds and short stroke, owing to the need for restricting height.

Vibration also is a more serious question where the forces are vertical—it is almost impossible to prevent transmission of vertical vibration from the bed to the ground. In a horizontal engine, one could put the underbed on rollers, but one could hardly support a vertical engine on springs. I know that cork

*From a paper read before the Birmingham District Electric Club on March 8th, 1913.

and rubber cushions have been used, but they are not, in my opinion, a practical solution of the problem of transmitted vibrations for large engines. The cost is very great, and deterioration must be fairly rapid.

Having indicated the fallacy of saying much on this question, I would like to say that, to my mind, the reciprocating gas engine is made vertical or horizontal just as fancy leads the maker, and it should be bought entirely on the question of cost of or availability of land. If one has cheap land available, it is of no real consequence.

Balancing of Engines.

In many cases we must avoid transmitted vibration, and the question of balancing of engines comes very forcibly before one. There are two or three propositions which should be laid down although I don't intend to prove them here.

(1) Unbalanced reciprocating masses can only be half balanced by weights on crankshaft.

(2) It is not enough to consider balance in two planes, but one must take three dimensions. That is, it is not enough to take two cranks at 180 deg. and say we get balance, because the pistons move in opposite directions.

(3) The out-of-balance forces increase in proportion to the speed squared.

(4) The forces of explosion have little or no effect on the question when one is considering vibrations external to the engine.

These elementary principles are not realized as fully as they might be. The out of balance forces are large in gas engines because pistons and connecting rods have to be heavy, and the piston speed must be high. From the above it follows that a single crank engine cannot be in balance. The best one can do is to resolve the unbalanced reciprocating forces into two, each half the amount, the one horizontal and the other vertical.

A two-crank engine, although nearly balanced vertically and horizontally has a rocking out of balance around a plane at right angles to the line of crankshaft, and parallel to and between the two cylinders. The nearer together the cranks can be got, the better the balance will be. The type in which there is a centre flywheel or a generator, and there are two lines of pistons, one on each side, is about as bad as can be from the point of view of balance. A two-crank engine with cylinders in line and pistons going in opposite directions is very good as far as balance is concerned, but is weak mechanically.

A four-crank engine can be nearly balanced if the two centre cranks are at 180 deg. with the two outside ones. A three-crank engine can also be nearly balanced in all planes. These few notes may serve as a guide in deciding types of engine for difficult situations.

Turning Moment.

Evenness of turning moment may be obtained by either multiplicity of cylinders or by heavy flywheels. This being the case, it is a question not for the purchaser, but for the engine maker. For electrical work, a cyclic variation of 1-150 is the worst that should be tolerated, and for A.C. work, 1-300 is the maximum which can be allowed.

Purchasers should forbid the use of two flywheels, one on each end of shaft. These tend to cause racking strains and shaft breakages. The flywheel should be the driving pulley itself, or close up to it. Breakages of crankshafts have practically ceased since the use of two flywheels have been abandoned.

Cylinder Construction.

This is one of the most difficult questions which the engine designer has to face. The difficulty is that the inside wall must be hot while the outer portions are cold. Then again, the compression space is hotter than the other portions of the cylinder. The exhaust outlet is subject to a higher temperature than the inlet. One also has to deal with cast iron, itself a metal particularly liable to initial casting strains, and very brittle anyway. The wonder is not that cylinder and jackets crack, but that they stand as well as they do.

Each maker has his own ideas of cylinder construction and support, but there are few who have really solved the question. The following points are important:—All inlets to compression space passing through the water jacket should be fixed to the cylinder only and be packed where they pass through the outer jacket. In multi-cylinder engines, the exhaust branch pipes should be long, and enter separately into the exhaust mains—or if this is not possible, then the exhaust manifold should be provided with expansion joints between each cylinder.

Cylinder liners are not often used in high-speed engines, and they are of doubtful use in low-speed engines. There is a difficulty in securing contact between a liner and the main casting, and there is a distinct risk of deformation. Practice is now fairly established in the direction of reducing cylinder wear, not in providing for renewal of wearing surfaces. In one make of engine (the "Premier") there is a liner of a most ingenious construction, in which the liner is the cylinder itself, and is separate from the outer casing of the water jacket, to which it is bolted at the combustion end. The liner passes through a gland at the outer end of the jacket, and the combustion chamber is bolted to the liner. This is the most perfect cylinder construction I have seen for a single-acting engine.

Cylinder Support.—The usual practice is to fix the cylinder at the outer end only, leaving it free to expand towards the combustion space end. With large horizontal cylinders the back end of the cylinder must be supported, but not fixed, so that it is free to expand and contract, but not to droop.

The exact shape and design of pistons is also a very delicate matter, especially in simple pistons not water-cooled. In the piston construction will be found the key to the success or failure of engines, say, 12 in. to 3 ft. bore. Some makers attempt to use uncooled pistons of 18 in. diameter, but this is, I think, a great mistake. My experience is decidedly against large uncooled pistons, and I should say that 12 inches in four-cycle gas engines and 9 inches in others is the limit for non-cooled pistons. If one considers what goes on in a gas engine cylinder, the reason for this statement becomes clear.

On the compression stroke there is a leakage of mixture past the piston, carrying with it oil and tar and grit, which work behind the piston rings. All along the compression stroke, the piston is overtaking the cylinder walls, i.e., collecting dirt from them. At the end of that stroke, the temperature has risen, and then with ignition there is still greater rise of temperature, and on the explosion stroke the oil on the walls is probably burnt, and then on the exhaust stroke is again swept up by the piston. The result is that with a hot piston head, hotter than the distilling point of the tar and oil, there is a constant transfer of thick oily matter to the clearance behind piston rings.

If the temperature gets above a certain point at the first ring, the thick oil and tar coke and become "carbon." This carbon forces out the piston ring and sets it hard, causing excessive friction and final seizing of the piston. It is here that one feels the disadvantage of multiple cylinders. Where the engine drives a dynamo in parallel with others, or a battery, the reduced speed causes the dynamo to drop the whole of its load, so that the whole power is available to do damage. In a single-cylinder engine the seizure stops the engine, and the mischief is usually confined to a second cylinder wall, but in a multiple, say 4 or 6 cylinder engine, there are five other cylinders working, forcing the sixth piston over its cylinder surface, with the result that the cylinder wall is torn to such an extent that the cracks go right through, and if one is not very lucky, the connecting

rod of the seized piston will buckle, or some other part will give way, wrecking the engine.

So many Diesel engines have been entirely wrecked from this cause, that the insurance companies are refusing to insure them. Certain types of high-speed gas engines are also liable to the same defect, and I am strongly of opinion that no large engine design can survive unless it has water-cooled pistons. It is strange that so great a trouble arises from such a small cause, viz., a piston head hotter than the burning point of oil and tar.

Valves.

As before indicated, I do not feel at all nervous over valves. They are now made non-water-cooled in all sizes. Cast iron faces with steel spindles and heads are standard practice for exhaust, while steel valves are usual for inlets. With heavy heads and long spindles well shielded from exhaust gases, there is no real trouble, i.e., the defect is hardly discovered until overhauling, when it is found that the face of the valve has a hole in it. Flat-faced valves are often used for exhaust and mitre faces for inlet valves, but the mitre seat gives the best shape of outlet, reducing throttling of the gases passing through. It is important that the cams be arranged to drop the valves lightly in the seat, and in many slow speed engines we have the rolling lever and eccentric gear for this purpose.

Lubrication.

The lubrication of a gas engine requires special care and much forethought. The cylinder lubrication in particular is a very awkward matter. It must be admitted that there is no oil which will stand the temperature of burning gases, and there can hardly ever be one. One might hope for an oil which would burn away, leaving no deposit, and until this appears we shall continue to have serious trouble with gas engine lubrication.

There is no doubt that any attempt to utilize splash lubrication for cylinders is a failure; one cannot control it, and too much oil is as bad as too little. Every vertical engine I know but one (and that a very expensive one) has a trunk piston, and, as a consequence, the oil from the big and little end splashes on to the cylinder walls, causing overlubrication. Baffles are usually put to reduce the amount of oil reaching the walls, but this is after all a crude method of control.

I am strongly of opinion that the successful engine of the present and of the future must have a crosshead, whether single or double-acting, horizontal or vertical. The crosshead must be a reasonable distance from the piston, so that oil will not splash on the cylinder walls, and one may then control the lubrication of the cylinder to a nicety. The crosshead also facilitates piston cooling, as there is more room for gear to get the water to and from the piston. There is no doubt that the lubrication of a horizontal piston is easier than that of a vertical type; in the horizontal piston if one delivers oil on the top there is little fear of the oil missing the bottom; it is bound to work down. In vertical engines, the oil should be fed to at least three or four points around the cylinder, and it must, of course, be forced in.

With reference to lubrication of engine bearings, the practice of Browett, Lindley and Bellis cannot be improved upon very much, but I should like to see the pumps external to the engine, and there should be oil coolers for large enclosed engines. The level of oil in the crankcase should be well below the cranks and balance weights, but lack of room often results in this being sacrificed. If, however, there is an oil tank external to the crankcase from which the pump sucks, and to which the oil returns, there need be no oil retained in the crankcase, and there is no fear then of large quantities of oil being picked up or blown up into the cylinders. The average vertical engine crankcase gets into a filthy condition, as it cannot be cleaned out easily, owing to the strengthening webs.

Governing.

There is no doubt that the best combination is quality governing from full to two-thirds load, with throttle governing below that, or what comes to the same thing, govern on the gas down to two-thirds load, and on air and gas after that. By this means, one runs on a good mixture at all times, retaining the thermal advantages of full compression at all but the lower loads, while at the lower loads there is a good mixture, no risk of misfiring, and consequent irregularity of running. One must, therefore, choose the system of governing to suit the conditions. It is, however, unnecessary to complicate the governing system, if one is not going to run much at under two-thirds load.

Ignition.

There is one very interesting point with regard to earth returns on ignition systems. It is absolutely necessary to provide a substantial return from the lay shaft to the frame. It is almost unbelievable that the lubrication of the bearings, etc., is, in the best engines, so perfect that there is no metallic contact between the moving and fixed parts of an engine. I have been compelled to fix substantial earthing brushes in several cases after an engine has been running a few weeks. These brushes get neglected, and for this reason should be in duplicate, and should be quite as mechanical as the main contact brushes.

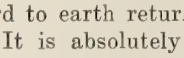
Starting.

Large engines to-day are always started with compressed air, usually for producer gas engines, at about 250 to 300 lbs. per square inch. In large cylinders, care is taken that no gas enters that cylinder until the air is shut off, but in smaller ones, the risk of a heavy pressure due to firing at 300 lbs. compression is taken. The chief point to safeguard in this matter is to have plenty of air storage, and, if possible, two compressors, to allow of three or four attempts in the event of the ignition being out of adjustment. Arrangements to use the compression of the engine to fill the tanks on shutting down are dangerous; gas may accidentally be mixed with the air.

Water Circulation.

A very few remarks on this subject will suffice. Circulating tanks are out of the question for large engines, so it becomes necessary to adopt some more compact form of cooler. There are several types of rotary coolers, in which a fan forces air over rotating surfaces dipping into the water. Again, one can employ cooling towers, which are very efficient, and the loss of water is little. Rivers, canals, or cooling ponds can rarely be used to-day, and tanks on the roof are very expensive. Speaking generally, one must force the circulation, and to do this a pump is required. This pump should not be driven from the engine; it is an absurdity to be compelled to shut down a large engine because a belt slips or breaks. There should always be a reserve from the water company, if sufficient can be obtained to supply the engine, or there should be a reserve pump.

I lay great stress on this question of water supply, because it is the weak point of most gas engine installations. There is no need to-day to put in ram pumps. For heads up to 30 ft., the new types of centrifugal and turbine pumps are more efficient, less likely to go wrong, and less expensive. There should be thermometers on the water outlets from various parts of the engine, and pressure gauges on inlet and outlet.



Metal Furniture.—The use of metal furniture in the offices of American street railways and other public companies appears to be gaining favor. Furniture of this kind is not much more expensive than wooden furniture of good quality, but it is more substantial, fireproof, and serves materially to reduce the rate of insurance. It is especially adapted for the storage of unimportant records.

Smoke Abatement in Pittsburg Metallurgical Plants*

By J. M. Searle **

Due to more active steps being taken by the civic rulers of our large manufacturing municipalities, and to a growing realization of economic benefits derivable by the manufacturers themselves relative to the prevention of smoke, considerable activity has been shown and progress made in different directions in the effort to combat the nuisance, and incidentally to conserve fuel.

I WISH to emphasize in this paper the following points:

First.—That the making of smoke is a direct waste of money to the manufacturer.

Second.—How to attain the best economy and at the same time produce a smokeless stack.

Third.—That the soot which colors the products of our furnaces can be, and is, burned, therefore the phrase "Smoke Consumer" is not a misnomer.

Fourth.—That smoke makers for their own protection, should be compelled to arrange their plants so as to render their stacks practically smokeless.

Fifth.—That much smoke does not indicate much prosperity for our cities.

Sixth. — That the smoke-belching stack should be condemned as a menace to every community in which it exists.

Seventh. — That a column of dense smoke belching from any stack is not only useless, but it is also extravagant and easily preventible.

No Mystery in Smokeless Firing.

To one having both practical and theoretical knowledge of the science of the furnace and the chemistry of combustion, which has come to him through many years of patient and untiring effort in actual service, the conditions under which unnecessary smoke may be abated are not mysterious.

Not a year has passed, however, during the last decade that has not witnessed the formation of societies of theorists for the abatement of smoke. These societies usually employ so-called investigators who, at considerable expense, continue their investigations indefinitely. Usually such investigators begin by attempting to devise some undiscovered method for mysteriously abating smoke, and always, of course, in blissful ignorance of the fact that the best trained and most successful engineering minds of the world have given the subject earnest thought for many years and have hundreds of smokeless furnaces to their credit in the mills and factories of various cities, about all of which there lurks no mystery.

Because of their connection with public societies, these investigators have easily reached the ear of the public and have succeeded in having their ideas exploited, but as such devices as these investigators exploit in the public press are usually found impracticable, the general public have come to believe the practical abatement of smoke well nigh impossible, when the contrary is easily true in every instance.

Installation Feature.

Of course, any one of our best and most popular smoke-abating devices known to-day (and there are many such) will fail of its purpose, if improperly installed, but the manufacturer and the combustion engineers, who have made this work their life study, will never permit such error of design or installation. In fact, the manufacturer of a machine-firing device that will eliminate smoke when properly installed will not sell his machine unless proper plant conditions exist. The day has long since passed when any old boiler and setting is considered a good place in which to install a high grade machine fireman.

There is no longer any mystery in the abatement of smoke. Tell the district manager of any of the good stoker manufacturers the maximum capacity you will force your boilers to deliver, and tell him you require this without a smoking stack, and he will never fail to produce the capacity you require with that smokeless stack or chimney. All that any of the good stoker engineers ask today is a free hand and they will produce the desired conditions at your plant. Such conditions may include the re-arrangement to some extent of your combustion chamber and chimney draught, but there is no question as to guaranteed smokeless results by the manufacturer.

Loss From Smoke.

Dense black smoke issuing from a chimney or stack unfailingly indicates waste of fuel. It also as unfailingly indicates the emission of great volumes of invisible carbon monoxide gas, which not only filters into and poisons the atmosphere we all must breathe, but which also robs the plant from which it is emitted of a greater portion of the fuel than (for the same period of time) is being converted into heat-energy for useful work; and this condition, of course, refers to locomotives as well as stationary plants.

When our stacks are smoky we have also an additional loss to the general public, caused by the unnecessary rapid soiling of everything we wear or handle. Who will say that the smoke and grime caused by the imperfect combustion and consequent waste of fuel in the coal-burning furnaces of our large manufacturing centres, do not add at least a dollor a month to the combined laundry and cleaning bills of each individual? and who has the hardihood to suggest that each of us does not pay another dollar a month to the dry goods merchant because of losses sustained in the rapid soiling of fabrics which must not only be exposed to unnecessary soot on shelving and counters, but handled time and again by prospective purchasers?

The Locomotive Stoker.

Probably the most important development in connection with the practical abatement of smoke in the past few years has been that of the successful locomotive mechanical stoker. From a viewpoint of one not familiar with the detail of locomotive construction and operation, it would prbably seem that the development of a locomotive stoker along the lines of well-known stationary practice would be very simple, but when one takes into consideration the limited space available for the application of the stoker to a locomotive, the variation in load, which is from zero to 100 pounds or more fuel burned per square foot of grate area per hour, and the limited space for the construction of the conveyor to convey the coal from the tender to the locomotive proper, and the mechanical abuse that the stoker is subjected to when the machine is run at high speeds, it becomes evident that the field of the locomotive stoker is distinct from that of the stoker which is successful in stationary practice.

The locomotive stoker is now a practical firing machine, after many years of continual experiments in which the railroads have spent large sums of money and a vast amount of patience with unwavering effort.

Requirements in Locomotive Firing.

Each class of locomotive in each class of service requires different treatment, necessitating a large amount of work in the development of the machine for the various services to be met. It is evident

*From a paper presented at a recent meeting of the Pittsburg Foundrymen's Association.

**Chief of Division of Smoke Inspection, Pittsburg, Pa.

that in developing the locomotive stoker, we must meet the following conditions or failure will result:

1.—We must have a machine capable of generating sufficient steam under all conditions of train lading and speed.

2.—A device to burn the fuel in an efficient manner, and in so doing provide a material reduction in the smoke.

3.—The device to be so constructed that it would form a part of the locomotive itself, and not a temporary attachment subjected to the whims of the operator.

4.—That in the application of the stoker no obstruction should be placed in the way of the fireman as far as access to the coal on the tender or to the fire door in the boiler for properly hand-firing the locomotive, either in combination with the stoker or with the stoker entirely inoperative.

5.—That the device should be of such character that its maintenance cost would be low and that it be simple in operation in order to avoid any additional work upon the fireman in operating it.

Improvement During Present Year.

While the outlook toward smokeless locomotives for Pittsburg has very greatly improved during the year 1913, in fact is much better than at any previous date, the same applies to the mills and factories which are always with us. Our office files, and the stacks and chimneys of our city plants and locomotives for 1913 show a marked improvement in smoke abatement over 1912; and judging from what data we now have for prospective equipment for 1914, the total number for the year 1914 will be greater than that of the smokeless installations made during the year 1913; and this changed condition is largely due to the fact that owners and operators have awakened to the fact that it does not pay to operate with smoky stacks.

A Typical Installation.

An instance of labor and fuel saving too important to pass by at this time without mention came to my notice quite recently. An old plant of 55 boilers had become worn out. The insurance company had cut the pressure to 85 pounds; the mill was loaded down with orders. It was concluded, as a last resort, to find a place to locate an up-to-date plant of boilers and double the steam pressure. Eight 600-horsepower units of the water-tube type fitted with good mechanical stokers were installed.

These eight new boilers are saving in pay roll $1,500 per month, and in coal $3,500 per month, which, as you will note, is $60,000 per annum, or six per cent. on one million dollars.

They have, however, done much more than this; they have increased the capacity of the entire mill, which increase is an additional source of revenue, and they occupy but 4,500 square feet of ground, whereas the 55 boilers which were thrown out occupied 45,000 square feet.

Test Data.

It so happened that an evaporator test was being conducted upon one of these 600 horsepower units on the day the writer last visited this plant, and an average capacity of 948 horsepower had been developed for about six hours. The eight individual stacks were absolutely smokeless and the products of combustion had averaged for this six-hour period 12½ per cent. of CO-2 gas; and yet it is frequently heard among men who call themselves steam engineers that we cannot rush a boiler and maintain a smokeless stack.

This plant, which is saving the interest at 6 per cent. on $1,000,000.00, cost complete, $130,000.00, including steel boiler house, main steam piping, feed pumps, Cochran feed-water heaters, ash and coal-handling devices, the latter being for both river and rail. Can better reasons or stronger argument, be produced for the erection of modern boiler plants than is shown by the books of the company from which I have just quoted, and which refer to eight months' operation of their new boiler plant.

In designing a furnace, we must not forget that no one type of device or appliance will suit all conditions. The smoke problem does not take more kindly to a universal "cure-all" than does the human system. On the contrary, each case of smoke abatement must receive individual treatment, or failure will result.

Fuel Conservation.

It has been said by experts of more or less ability that the coal of this country will last for many centuries at our present rate of mining.

A certain manager sent his fireman to jail for stealing a few hods of coal. A few months later a combustion expert showed this same manager how he could save 20 per cent. of his coal at a very small expenditure. He never budged; he was evidently concerned more in the manner of the loss than the cost of it. There are too many such managers. Too many of them prefer to continue paying the cost of the same needed improvements each year rather than invest the money so wasted in improvements that would at once stop such payments and commence to increase dividends at home, and, in many instances, render their plant a joy rather than a continual nuisance to their neighborhood or community.

Accessory Aids.

It must not be understood that the installation of a good mechanical stoker is the last word in boiler room or metallurgical furnace economy, or smokeless combustion, for such is not true.

If we expect to produce high furnace efficiency and smokeless plants we also need some reliable form of CO-2 recorder in our boiler or furnace rooms; also our pyrometer and differential draughtage must constantly point to results. Then, too, in boiler practice the arrangement and relative position of the absorbing surfaces has much to do with plant efficiency. Also the nature of the load carried must be considered when selecting our machine-firing device.

Again, we must not expect too much of the man in front of the boilers, whom we pay from $1.75 to $2.50 per day. We must not expect such a man to understand the chemistry of the furnace. If we do, we will suffer disappointment, for when he has cleared the cobwebs from his brain sufficiently to appreciate the difference between the value of C-0 and CO-2 gas as heat producers, he will have a better job. No, you must place a practically fool-proof "machine fireman" in the hands of the average coal handler, and instruct him to call the engineer when trouble appears, if you expect to conserve your coal pile and produce high furnace efficiency and a smokeless stack. As time passes, your fireman will perhaps call the engineer less frequently, and finally he will understand and care for the machine himself.

The Evaporative Test.

Engineers have spent much thought and money on compounding high-class reciprocating stationary engines and locomotives, and in designing many types of steam turbines, in order to grab the last unit of energy from the steam they have generated, but in far too many instances they have simply closed their eyes to the appalling waste of energy that is constantly sneaking dividends out of our stacks.

It is still considered quite the proper thing by many of our plant engineers to refer all ills in the boiler house to an evaporative test that records the amount of coal used and water evaporated in a given time, but without any reference to gas analysis. When such a test has been completed, the engineer gathers up his memoranda and proceeds to figure out, as he says, the efficiency of his plant, without a scrap of data as to the composition of his products of combustion.

Does he get much information of value from such a test? Not very much. He has commenced at the wrong end of his job. He should have first gone on a hunt for his percentage of CO-2 (carbon dioxide gas) in his furnace products at the

breeching. When he had finally determined this, and had brought it up to his liking, would have been time enough to hunt for the efficiency of his boiler or furnace.

Don't commence at the top to run an efficiency test in a boiler house or on a metallurgical furnace. Commence at the coal pile and go up, if you are really looking for results. If more boiler tests were commenced at the coal pile, carried through the furnace and breeching, and finally to the absorbing surfaces, instead of beginning at the absorbing surfaces, more data of value would be on record, and more smokeless stacks would exist, for after all, the last word in smoke prevention with our high volatile coals is and must remain at least 14 to 16 per cent. of CO-2 gas in our products of the furnace, whether such furnace may be for metallurgical, stationary, or locomotive purposes.

"Burning Smoke."

It has been said that the phrase "smoke consumer" is not scientific and that it should not be used, and that smoke, once formed, cannot be consumed. I wish to make it plain here that while I have much respect for the memory of C. Wye Williams and his valued records of research upon the lines of combustion, I cannot agree with him in this particular instance. What is this thing we are prone to call smoke? What makes it black? Is it not carbon passing into the stack at a temperature so low as to form what we call soot? If it is carbon, and I believe we will all agree that it principally is, what must we do to burn it and convert it into the invisible harmless, heat-producing gas called carbon dioxide, CO-2?

The answer is among the easiest of those that are required of the combustion engineer to-day. Supply two volumes of oxygen to each volume of carbon and the ordinary temperature that should obtain in any combustion chamber under any boiler or in any metallurgical furnace, and so arrange your combustion chamber as to force as nearly perfect contact of your oxygen and your carbon particles as may be found practicable, and your soot will never get through that combustion chamber, no matter how dense and black it passes over the bridge wall.

Stack Records.

Some may ask, how are we to know when we have the correct, or approximately correct, volume of air for complete combustion?

First, and accurately, by the use of a good CO-2 Recorder. Second, and approximately, by the intelligent and occasional observation of the top of your stack. Never (when you are not using a CO-2 recorder) let the top of your stack run absolutely clear, if you expect the best average efficiency from your furnace. Carry a haze at your chimney top equal to about 1-10 of No. 1 "Ringlemann," and you will be sure of having a high average percentage of CO-2 in your products of combustion. If, on the other hand, you have no combustion recorder to guide you, and you are running an absolutely clear stack, your surplus air may not only be enough, but it may be many times more than is required for high furnace efficiency, and while a practically smokeless stack always accompanies high furnace efficiency, on the contrary, as you have seen, a smokeless stack does not always indicate such efficiency.

Burning the Gases.

The greatest difficulty in burning bituminous coal smokelessly and with high furnace efficiency lies in the fact that it burns partly as a solid and partly as a gas, and that the gas must be burned in a time much shorter than is required to burn the solids. It may be of interest to note here that 100 analyses recently made have shown that an average of 42 3-10 per cent. of the total heat developed by average Pittsburgh coal is contained in the volatile combustibles, and for the combustion of this hydro-carbon content, a fixed portion of our total air supply is required over the fire.

After some thirteen years, during which I have been constantly in touch with the steam engineers of Pittsburgh, I feel safe in offering the suggestion that these last two conditions are not given the careful consideration that is bestowed upon other details of plant operation. In other words, the adequate supply of oxygen over the fire at the moment when something like 40 per cent. of our gaseous and extremely valuable hydro-carbons are being distilled is rarely, if ever present. In fact, very few plant engineers dig down into the science of the question at all. If they did, the thought would quickly occur to them that we get no smoke from the solids in the fuel (the coke), therefore we must get it, if at all, from the volatile constituents, and if these contain fuel to any appreciable extent, we had better get busy and convert this fuel into useful energy.

When the careful engineer visits a power plant in some one of our good city buildings or mills, and notes the perfect order and organization in the engine room, including expensive compound condensing engines, and then remembers that the boiler stacks issue excessive volumes of smoke, it must indeed, to use a homely phrase, suggest "saving at the spigot and wasting at the bung hole."

Oil Ring Bearing Query.—On my dynamo the oil ring bearing next to pulley throws the oil out at the ends. I would like to know the cause of the trouble and how I can remedy it.—George Munro.

GUNMETAL.

A VERY interesting paper on the heat treatment of admiralty gun metal was presented to the annual meeting of the Institute of Metals, and is published in Volume IX. of the Institute's "Journal." The authors of the paper, H. S. Primrose, G. & J. Weir, Ltd., Cathcart,) and J. S. G. Primrose (Royal Technical College, Glasgow), described the results of recent very careful and minute quenching and annealing tests.

In the course of their deductions, they said that it was evident from the practical tests made, that reheating and quenching gun-metal castings does not effect any improvement, even if this were possible without damaging the shape of the casting. In practice it is not feasible to quench the metal immediately after it has solidified, although this may have been done with test-bars which were quenched direct, without having first cooled to the ordinary temperature, and then reheated, as were the bars tested in this series.

Annealing.

The simple operation of annealing was tried upon sets of test-bars which were cast and cooled in a variety of ways. The treatment consisted of a gradual heating up to various temperatures, at which they were maintained for various periods of time. The subsequent cooling in each case was moderately rapid until 400 per cent. was attained, after which it was comparatively slow.

From the test results submitted, the importance of the annealing of gun-metal castings, which in service have to stand severe tests, was abundantly evident. One great advantage it possesses, said the authors, lies in making the metal capable of complying with the most stringent specification as regards tensile strength and elongation, although it must be clearly pointed out that it cannot be regarded as "faking" the metal. Such metal as may be defective due to the presence of gas or blowholes is not materially improved by this heat treatment; but when slight defects arise, due to the harmful segregation of the eutectoid structure, then this is completely removed by the proper annealing.

Water Pressure Test.

One of the most frequent tests now applied to important gun-metal castings is that of water pressure, and in many cases they fail most dismally under even moderate pressure. The metal is thus condemned as bad, whereas it is really quite good, and it is only a strange characteristic of the metal possessing the wrong arrangement of its constituents which makes it unsuitable for this purpose when cast, and not further heat-treated as suggested in this paper.

ELECTRICITY AND HYDRAULICS

This department is intended, in addition to individual treatment, to feature the close relationship existing between electricity and hydraulics in the power and light field.

STEEL PIPES VERSUS CAST-IRON PIPES.

AT the present time, says the Foundry Trade Journal, some engineers are being tempted to put down steel pipes instead of cast-iron, owing to the saving in capital expenditure, without thoroughly looking into and comparing the risks attached to steel, and the ultimate cost of same. It is most important that all the facts obtainable should be considered before arriving at a decision as to which material to adopt. Owing to the thinness of the steel pipes, and their liability to corrosion, the life of a steel main is entirely dependent upon its protective covering, and as corrosion takes place most rapidly where the steel main rests upon the ground, and where it is practically impossible to re-coat the pipes, it is obvious that if corrosion once commences, nothing can stop it. Engineers who have had experience with steel mains are mostly agreed that its use is limited to (1) very high pressures, (2) temporary purposes, (3) cases where it is physically impossible to put down cast iron, and (4) cases where the initial cost of cast iron is the most important consideration.

Steel Pipe Failures.

At Port Elizabeth, recently, in the course of a Town Council discussion on the waterworks, it was stated that seven million gallons of water were being lost monthly between the waterworks and the town, owing to leakage in the pipes. When the new waterworks were constructed some six or seven years ago, some thousands of dollars in the cost of transportation were saved by laying down steel mains instead of cast iron. Washaways, over a year ago, however, revealed the fact that this steel pipe was not wearing at all well; in fact, at several points it was discovered to be completely rusted through. The defective pipes were replaced, but it now transpires that practically the whole main, covering a distance of over 25 miles, is affected and will have to be replaced.

There are many other steel and wrought-iron failures. The steel main over the Tay Bridge, Scotland, was laid in 1891 under the most favorable conditions, being protected from all climatic conditions by being enclosed in a wooden box. The main has been kept carefully coated with bitumen at a serious annual cost, but, in spite of this, it was found to be defective in 1910. The steel main is being replaced by one of cast iron. The Coolgardie, Australia, main of 350 miles of 30-in. steel pipe, was laid in 1903, and found in 1906 to be defective.

There are many other failures, amongst which are:—Rochester (U. S. A.), 26 miles of 38-in. pipes, defective in four years; San Bernada (U.S.A.), defective in three years; Lockport (U. S.A.), defective in two years; Bombay Port Trust, defective in four and a half years; and others. Most of these and many others have been replaced with cast-iron after a very few years.

As against these steel and wrought-iron failures, there is not a single known case of a failure in cast iron, with the exception of one or two isolated instances where the ground was such that possibly no material would have had a long life. The life of cast iron mains is known to be over 100 years, as instance the following: — Versailles, 249 years; Weilburg, 210 years; Claremont-Ferrand, 165 years; Glasgow, over 100 years. The Vehar mains in Bombay after 55 years' service are now being lifted and relaid within the city.

MOTOR ARMATURE MISHAP.

THE September issue of Vulcan contains a picture of an armature in very bad condition. It is—or rather, it was—the armature of a 55 horse-power series wound direct-current motor, driving haulage gear in a mine. The motor and haulage gear were situated in a small chamber in the mine, but for some reason which is difficult to explain, whilst the motor was working at full load, and, therefore, at normal speed, the band at the back end of the armature burst. Apparently the engineer lost his nerve, and without thinking of the consequence, immediately threw out the clutch, so removing all load from the motor, and then rushed out of the engine-house.

The motor being series wound, as soon as the load was thrown off, the speed increased, and the centrifugal force caused not only the armature windings to fly, but also the commutator spider to burst. When the engineer returned, the machine was a complete wreck, bits of the commutator were lying all over the floor, the armature windings were twisted, whilst the field coils had been damaged by the loose ends of the armature windings catching against them.

Upon further investigation it was discovered that the shaft was bent, and that the core plates of the armature were loosened. It was found possible to utilize the carcase of the machine, but the field coils had to be entirely rewound, and a complete new armature and commutator with shaft fitted. Had the man opened the switch, all this trouble would have been saved.

TWO DAMS FOR THE SOO.

THE international joint commission which has been meeting in Ottawa, has disposed of the preliminary hearing of the application of the Michigan and Lake Superior Power Co. for permission to build a dam at Sault Ste. Marie, and granted the application of the Algoma Steel Corporation for a preliminary hearing for a request to build a similar dam from the Canadian side.

The Michigan and Lake Superior Power Co. applied to the United States Government for a lease which would enable them to develop power as far as the international boundary. The government has been considering the leasing of this water to them, but has submitted it to the international joint commission, which has jurisdiction over such matters. Similarly the Dominion Government, which has under consideration the leasing of like privileges on the Cana-

dian side to the Algoma Steel Corporation, will have the case passed on.

The two companies propose to build a dam from each side of the international boundary, which will meet in the centre to form one project. The whole will result in a considerable diversion of water, and further hearings will probably be held in Sault Ste. Marie, to enable any local objections to the scheme to be heard.

SINGLE PHASE COMMUTATOR MOTOR.

WE learn from Electrical Engineering that the single-phase commutator designed by E. F. W. Alexanderson, some particulars of which were given in a paper before the American Institute of Electrical Engineers in 1908, has given such satisfaction on motor coaches of the New York, New Haven and Hartford line, that new equipments of the same design have been ordered.

It is a repulsion motor at starting. The heavy starting current is induced in the rotor, this reaching 1,200 amperes with a current of only 500 amperes in the contactor circuit. After a certain speed is reached, the windings are changed over to a combined series, repulsion connection, giving a better efficiency at high speeds. These motors are designed for 25-cycle operation, and it is stated that at this frequency the life of the brushes is as good as is obtained with a normal direct-current traction motor. The rotor acts as a ventilating fan, sucking air in through openings in the stator, and blowing it out at the commutator end. This method of cooling is said to keep the motor both cooler and cleaner than that of forced ventilation from outside.

A locomotive with four 400 horsepower motors of the same design has just completed a several months' test satisfactorily.

METHOD OF SPLICING PAPER AND CLOTH BELTS.

ADVERTISEMENTS relating to improved machinery are usually read with a quaking heart by a large number of workmen, says H. H. Miller, in the Abrasive Age, as many of them are apt to think that it is their scalp which is referred to in the statements that the machine will do the work of several men, and in half the time. They do not stop to think that these machines, or nearly all of them, will require men to attend to them. If some of the workmen who keep their finger nails down to the quick, pushing a sandpaper block, could see the working of a good up-to-date belt sander, I believe they would welcome the opportunity to run one. In operating these machines there is much more opportunity to become a skilled man than at the bench, and the work is so much easier.

I am frequently questioned concerning the splicing of paper and cloth belts, and which method is the most generally used. In this, as in numerous other operations, there are different ways of getting practically the same result, and while shop conditions, machine makeups and finish required in a measure affect belt slicing, yet there are some operators who think that, as long as this or that method gets by, why experiment with other methods.

My experience is that the panel paper belt operators mostly use the interlocking belt-splicing dies, cut at an angle of 45 degrees and some at right angles, backing up the splices with a very light cloth. The straight, butted end splice, cut on the bias, is the favorite on high-speed machines carrying cloth belts, while on the slower speed machines, I find the operators lapping the ends, one of which has had the sand soaked off, while others lap them just as they are cut. These lapped splices are generally made at right angles.

One of the prominent chair manufacturers in Gardner, Mass., has, in my opinion, the best method for splicing cloth belts. It is a method which is extremely simple and can be carried out by a fifteen-year-old boy. By this method belts are produced that neither jump nor pucker, that are never even found to start at the splice, and the full life of the cutting material is obtained. The method is as follows:

A 24-inch straight edge is fastened to the back of the bench, to one end of which is bolted, at an angle of 45 degrees, a 20-inch discarded planer knife, cutting edge up. To the back end of this and edge down, is bolted another knife having a wooden handle; this forms the shear. Underneath the bench is swung the roll of cloth, and this is brought up over the end, grain side down, a wooden roller keeping it from fouling the knife. After being cut, the belts are suspended from a convenient arm overhead, making them easy to handle. The ends are then butted and secured with sharp-pointed nail blocks.

The splice is covered with moistened gummed tape one inch wide and several strips two inches wide are run across the splice lengthwise with the belt. Two dozen of the belts are made up at a time, and the whole batch is put in a home-made hand press. At the end of twenty minutes they are taken out and hung up for an hour to dry, after which they are ready for use. The neatness and despatch with which these belts are turned out is well worth the trouble and small outlay required.

THE FINISHED SPLICE.

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FREE SUPPLIES TO STUDENTS.

A RECENT decision of the Advisory Industrial Committee of the Board of Education makes free, to all pupils in the first year industrial course at the Toronto Technical School, books, drawing instruments, science supplies and lockers. Despite a strong protest on the part of one member of the committee, the proposal, which originated with the principal, got the necessary support for its enactment.

To our mind the step is a retrograde one, and gives abundant evidence of the lack of appreciation of human nature as found in our industrial workers, or for that matter, among any body of civilized people, on the part of those who supported the proposal. The principal's plea that, by adopting the scheme, classes unfilled would receive the necessary complement, has no foundation in fact or experience, and he forgets that while it looks well to see a report in the public press that no more students can be enrolled, his business and the purpose of the school is not to pack or herd human beings together, but to teach and train them.

The decision anent the already mentioned equipment is nothing more or less than cheap philanthropy, yes, gallery play, and were its results no more hurtful or impressive than these, the affair would not be worth even passing notice. There is, however, a serious side to the matter, the pauperizing feature, and beyond that again is the certain tendency to indifference to any instruction given, because of there being nothing really tangible at stake on the part of the individual. If a student pay his fees and buy his equipment, he does so with some determined purpose in view, and although many, even under these conditions, fall away later from their ideal, there is more hope of a larger percentage making good than under a regime where something is bartered for nothing.

We all sympathize with the student who is apparently barred from participating in the benefits and privileges of the technical school because he lacks the seven dollars, but we do him more injustice still if we make him a pauper. The lad who is in earnest about his education, or about anything, as a matter of fact, will get there, if left to himself, and while he may not get there just when he wants, he will be none the worse but a whole lot the better for it, as it will have put some real manhood into him. None of us get what we want, nor when we want it, and in taking ourselves to task on the subject we must all admit that we are better as a consequence. Bribing a boy with supplies will, in no shape or form, educate, and if education is worth anything to-day, and if those who are responsible for its imparting knew their business, then a higher standard of manhood should be the goal.

Another aspect of the technical education question is that exemplified by teachers giving their services gratuitously. More philanthropy, you say. Yes, and equally futile. In this twentieth century we had believed that the veriest child realized that there was no such a condition in our economy as something for nothing, yet, here in Toronto Technical School there have been teachers giving their services free, with the result that the management has become dissatisfied. We have all got to be bound down to our task, and a reward for the latter takes away most of the irksomeness involved, but where philanthropy reigns, the loosening of the binding feature proves the only reward, and the performance suffers. This wholesale disregard of the real place and function of our technical school is, to say the least, appalling, and occasions no surprise among those who know the circumstances under which our youth are being trained and educated, not only to take their own place in the march of progress, but to bring our country, at least, on a competitive level with other industrial nations.

A MAN'S value to his employer is not in his large bones and muscles, his weight lifting and strenuous physical labor. Human muscle power is the most expensive form of energy used. A man is valuable in proportion to the thought, the physical inspiration, and the happiness he puts into his work. A man, doing work that he does not love, lacks enthusiasm, interest, and concentration, therefore, is not efficient.—The Leviathan.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in the Power Field.

ELECTRICAL ENGINEERS CONVENE.

THE Pacific Coast Convention of the American Institute of Electrical Engineers opened on Tuesday, Sept. 9, in the Odd Fellows' Hall, Pender street, Vancouver, B.C. The convention proper began in the afternoon, when Mayor Baxter made his address of welcome.

The representation included many prominent electrical engineers, and the papers which a number of them read were of high standard. On Tuesday afternoon, C. F. Uhden, chief engineer of the Washington Water Power Co., of Spokane, read a paper on "Snow and Ice Loading on Transmission Lines," prepared by Mr. V. M. Greisser, an electrical engineer with the same company.

"Mountain Railway Electrification" was the subject of a paper on Wednesday morning by A. H. Babcock, chief electrical engineer of the Southern Pacific Railway at San Francisco. In the evening there was a lecture in the Progress Club on "Some Features of the Panama-Pacific Exposition," by Mr. A. H. Halloran, managing editor of the Journal of Electricity, Power and Gas," of San Francisco. Prof. Karapetoff of Cornell University gave a piano recital at the same time.

Thursday morning was taken up with a paper on "A Modern Substation in the Coeur d'Alene Mining District," by J. B. Fisken, superintendent of the Washington Water Power Co. of Spokane, and a paper on "High Voltage Circuit Breakers" by K. C. Randall, chief engineer of the switchboard department of the Westinghouse Co., Pittsburg. A paper on "Logging by Electricity" was was read by E. J. Barry, electrical engineer for the St. Paul-Tacoma Lumber Co. of Tacoma, on Thursday afternoon. In the evening a banquet was tendered the delegates at the Terminal City Club.

On Friday the delegates visited the power house of the Western Canada Power Co., at Stave Lake as the guests of the Company, lunch and dinner being served there. On Saturday they went to Lake Buntzen as the guests of the B. C. Electric Railway Co., the boat Alluvia being specially chartered by the Company for that purpose.

The Vancouver section of the American Institute of Electrical Engineers was organized two years ago, being the second in Canada. E. M. Breed, the local manager for the Canadian Allis-Chambers Co., is the chairman in Vancouver, while L. G. Robinson is the secretary.

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FATAL BOILER EXPLOSION AT COLLINGWOOD.

A FATAL explosion occurred at Collingwood on the afternoon of September 23, W. and F. Shell were at the Blackstock farm looking at a threshing machine, boiler and engine, which they thought of buying. The Blackstock brothers, Edward and Neil, raised steam to demonstrate the fitness of the boiler, when the steam reached 80 pounds, the boiler suddenly exploded, tearing in two about the middle. One part shot forward about 25 feet, and the other backward about 45 feet over the fence into an orhard. Edward Blackstock was struck by the latter part and died a few minutes later. His brother was severely injured, but will probably recover. The Shell brothers were unhurt though standing close to the side of the boiler when it exploded.

AUTOMATIC REPLACEMENT OF ELECTRIC LAMPS.

AN improved device for the automatic replacement of electric lamps for signalling is, according to the Electrical Review and Western Electrician, now being given a trial by the Pennsylvania Railway Co. If successful, some thousands will be used. In this new device, a disc holding four lamps is pivoted within the lantern, one lamp burning in focus with the signal lens; the other three lamps being in reserve. When a burn-out occurs, the bad lamp is immediately thrown out of focus, and a good lamp substituted. This practically eliminates one of the greatest troubles now being experienced, that of maintaining a lighted electric signal regardless of lamp burn-outs.

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THE OPERATORS' VIEWPOINT

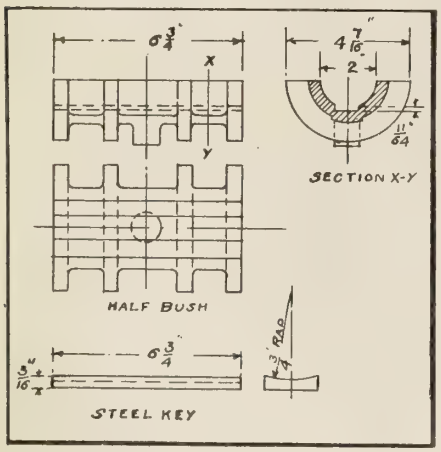
Devoted to brief descriptive article contributions covering ideas and experiences pertaining to power plant practice and operation. We pay for accepted material.

ELIMINATING THE WEAKEST LINK.

By George Black.

IN seeking to operate machine tools at their highest efficiency, commensurate with their depreciation, the weakest link of the chain is constantly in evidence. In that of transmission, we frequently find it in a main drive pulley slipping on the shaft, due to the extra power required to pull the increased speeds and feeds, made possible by the higher efficiency of machine tools and tool steels. The slipping scores the shaft and cuts up the cast iron bush, making it necessary to tighten the bolts.

The capacity to drive is reduced each time the pulley slips, owing to the before mentioned scoring and cutting action, between the shaft and bushing, and the application of emery cloth between them only gives temporary relief, for if the pulley is being overloaded, it will not drive satisfactorily either by increased tension on the bolts or the introduction of emery cloth.



ELIMINATING THE WEAKEST LINK.

The sketch shows a method of effectually eliminating the trouble, which in this case was caused by operating 7-24 in. Bullard vertical turret lathes at their capacity on a particular class of work, and was applied to a 2 in. diameter shaft. The pulley and bush were removed, and in each half of the latter a shallow keyway was cut and key fitted, as per sketch. The point to watch is that the radius of the curve in the key is less than that of the shaft to which it is to be applied. The pulley and bush on being applied to shaft and tightened thereon forces the sharp edges of the key into the shaft and the trouble caused by the overload is transferred to probably the unfortunate belt man.

ENGINE TESTS FOR MISALIGNMENT.

By James E. McCormack.

HEREWITH are some engine tests which I have found useful. The fact that a number of men have (after assisting me to make these tests on the engines which they themselves were in charge of) voluntarily assured me that they had never before seen similar tests applied emboldens me to affer them thus.

If a clean, properly-designed and properly lubricated crank pin bearing persistently heats when keyed just tight enough to eliminate the knock, the trouble may be due to the crank shaft or the crank pin being out of line, or to the bore of the crank pin brasses not being at right angles to the centre line of the connecting rod.

Test Procedure.

To test for these defects, on an engine that has run long enough to have its brasses bedded to fit the crank pin properly throughout its whole length, uncouple the connecting rod at the cross-head end and adjust the crank pin brasses so that they lightly bind on the pin. This can be ascertained by moving the disconnected end of the rod back and forth. Next, put the brasses and keys in the cross-head end of the rod, but keep it disconnected from the cross-head. Now move the cross-head so that the brasses in the rod stand directly over the cross-head journal and note if they do stand directly over or a little to one side.

The crank should now be moved one-quarter revolution, and the detached connecting rod end again lowered onto its journal, the operation being repeated at each quarter revolution, preferably at the dead centres and mid-strokes. If in each case the rod end falls into its place without requiring to be sprung or forced sideways, it is proof that the main shaft, crank-pin and crank-pin brasses are all true. If the rod stands to one and the same side equally at all four points of the revolution, it is proof that while the shaft and crank-pin are true, the bore of the brasses is not at right angles to the centre line of the connecting-rod. If the rod end varies, passing during a revolution sideways over both sides of the cross-head journal, it shows the crank-pin to be out of line. If it varies, but always remains on the same side of the journal, it is the main shaft that is out of line.

Under the above conditions, to hold the rod end to its place at all times would require a strain sufficient to spring the rod by force, and this strain would be transmitted to the crank and cross-head pins through their boxes, and as the direction of the strain reverses with each stroke, it produces a knock.

If the crank shaft is level, but is not at right angles to the line of the engine, or if the outer end of the crank-pin is inclined upward when the engine is at mid-stroke, either top or bottom, then this strain will be greatest when the engine is at the dead centres, but if the outboard end of the crank shaft is high or low, or if the outer end of the crank-pin is inclined upward, most when the engine is on one dead centre, then this greatest variation and the greatest strain will be at mid-stroke, and it is not at these points that the resulting knock will occur.

The cross-head pin and the bore of the cross-head end brasses may be examined in the same manner, except that it is not necessary to test these at four different points. If either are out of line, you can make certain which is at fault simply by (where possible) connecting the rod to the pin upside down, and then if the fault is in the brasses, they, being now upside down, will incline the rod to the opposite side from where it stood when connected right side up. This test

is very seldom necessary owing to the small amount of wear at this point.

Adjustment Pointers.

I will now conclude by mentioning a couple of items which, although most generally known, may be of assistance to some of the beginners who are readers also.

When adjusting the connecting rod brasses it is well to have the engine on centre for adjusting the crank-pin brasses, and at mid-stroke for adjusting the cross-head journal brasses, for by this method the brasses are keyed to fit the least worn or "high" sides of the pins.

Sometimes when an engine develops a knock, which occurs only once in each revolution, the knock may be caused by the clearance between the piston and the cylinder head not being equal at each end of the stroke, or it may be the result of too early admission or too late a release at one end, either of which can be detected by means of an indicator, and the rods adjusted accordingly. Of course, it is well to be sure that the knock is not due to improper adjustment of the guides or unequal clearance before changing the valves.

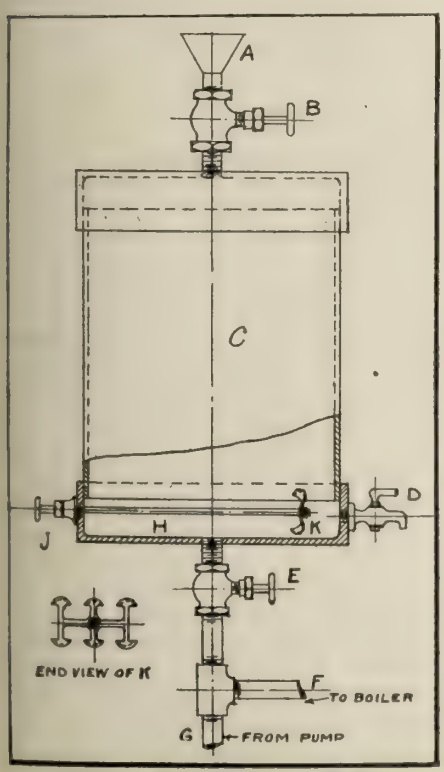
BOILER COMPOUND FEEDER.

By N. E. J.

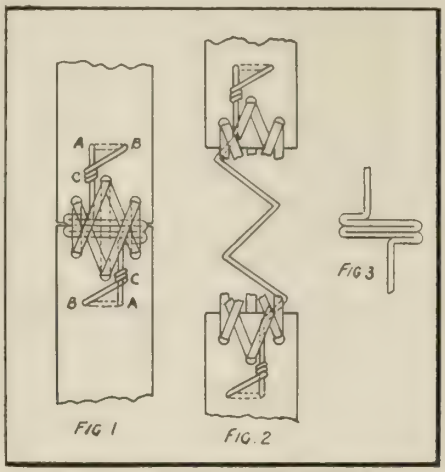
A COMPOUND feeder for steam boilers is here illustrated. The compound is fed to the boilers without passing it through the pump. A funnel (A) is attached to a round-way valve (B), and the compound chamber (C) is made with two caps and a piece of pipe of any desired size. The stuffing box, hand wheel, etc, shown are from a small valve, while (H) is an agitator, which, by pulling in and out on the handle at (J), causes any undissolved compound lying on the bottom of the chamber to be mixed up with the water. The operation is as follows:—

Close valve (E) and empty the chamber by opening cock (D). Close (D) and (E), open (B), and fill the chamber with the dissolved compound, then close (B). Next, open (E) a little and start the pump. As the compound is heavier than water some of it will run down and enter the boiler with the feed water. It can be fed slow or fast according to the amount of opening given valve (E).

It would be interesting to have our readers' views on this equipment, and correspondence is invited accordingly.—Editor.



BOILER COMPOUND FEEDER.



SAFETY KINK FOR BELTS.

SAFETY KINK FOR BELTS.

By J. C. E.

MANY serious accidents have occurred on account of belts breaking and the ends come flapping down and striking workmen. It is seldom that a belt parts or breaks in two, other than at the lacings, or the holes giving way where the lacing passes through. In the enclosed sketch is shown a kink that will prevent a belt from falling when the lacing breaks or pulls out.

In Fig. 1, is shown a piece of insulated belt-wire. It is bent up in folds, see Fig. 3, and placed on the belt when it is being laced up—the lacing holding it in position. The ends are placed through holes at (A), then bent at right angles on the inside of the belt, and passed out again through the holes at (B). The ends are also twisted a few times around the wire at (C). When the belt lacing breaks, or the holes give out, the belt ends will then draw apart, and the folds in the wire will be drawn out also. This renders the belt slack, and, instead of falling, it will only lay or remain at rest on the shafts. Fig. 2 shows a broken belt pulled apart. A number of these wires should be made up and kept on hand for emergencies.

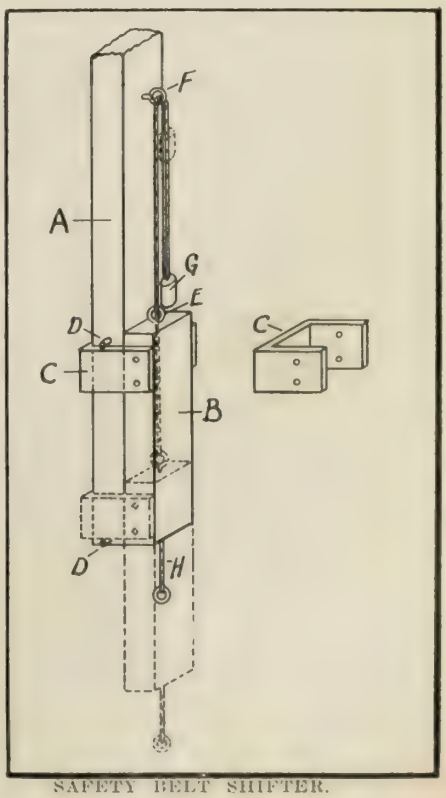
SAFETY BELT SHIFTER.

By James E. Cooley.

IN nearly every factory there are to be seen a number of "belt shifters" extending down so low, that employes working near are constantly banging their heads up against them. Many workmen have been nearly knocked out, or have received deep cuts from these belt-shifters. If a "shifter" is up too high, a short person cannot reach it, besides it is necessary that it be as low down as possible, so that it can be grasped firmly, and the arm movement be directly forward from the shoulder.

In the accompanying sketch is shown a "belt shifter" that can be left as high as necessary, and yet the shortest person can reach it. A guide (C) is made from a piece of sheet iron and fastened to a wood extension (B), which is then placed on the shifter (A). Two pins are driven in the side of the shifter at (D), and act as a stop when the extension is moved down and up. Two screw-eyes (E) and (F) are placed as shown. Attached to (E) is a light chain, that slides through (F), having a small counterweight (G) fastened on the end. A similar chain, any convenient length, is placed at (H).

The method of operating is simply to pull down on the chain (H), grasp the extension (B), and move the "shifter"



SAFETY BELT SHIFTER.

as required, then by letting go, the weight (G) pulls it up out of the way. There is no danger then, that it can ever be left down. The chain (H) should be long enough so that the shortest person can reach it. It can never do any harm when run into.

REMINDERS FOR DETAIL DRAFTSMEN.

By E. W. Tate.

A DETAILER should always bear in mind that:

In all places where bolts, studs, cap screws, etc., are used, care should be taken to allow enough room for the use of a standard wrench.

A hexagon nut should always be used wherever the movement of the wrench is limited.

Some means should always be provided for holding bolts from turning while the nuts are being screwed on, if the wrench cannot be used on the head of the bolt.

Bolts, cap screws or nuts, when used in connection with cored holes, should be supplied with washers for providing sufficient bearing surface for the nut or head.

The ribs of a gear should never be made flush with the rim or hub, but should come from ⅛ to ¼ inch below the rim or hub face, for the rim and hub cannot be finished without making an unsightly job.

Whenever possible the supporting ribs in castings should be put directly under the load.

When making sub-bases, base plates, pads, etc., for machines, motors, engines or other parts, an allowance of from ⅛ to ¼ inch of planed surface be provided, outside the dimensions of the machine to be attached, for castings can never be depended upon to come true to dimensions, and it always looks a great deal better to have base pads project rather than to be too small.

In selecting the number of teeth in a gear care should be exercised to select only such numbers of teeth as can be cut with the regular indexing gears, as special gears for indexing are not only expensive, but oftentimes cause much delay.

A gib key should not be used to secure a coupling on a shaft. A headless key or feather will be found better.

When cold rolled shafting is used, an allowance must be made in the bore, as this shafting will be found to caliper exactly or a trifle over size.

When turned shafting is used, the bore must be standard and the allowance made in the bearing.

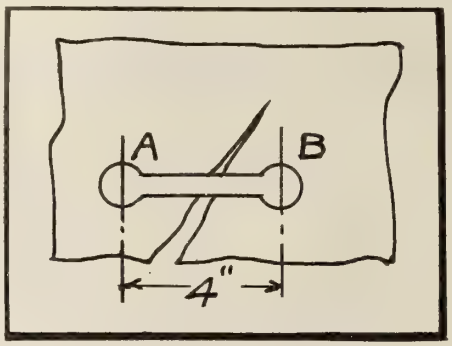
Rivets should never be used in direct tension, and that, under such circumstances, bolts and nuts should be used in place of rivets.

REPAIRING CRACKED FACE WITHOUT PATCH.

By William Stewart.

TO repair any working face which is cracked and where it is undesirable or impossible to fit a patch with screws or rivets:—

Drill with flat drill the holes (A) and (B), 1½ inch diameter by ⅜ inch deep



CRACKED WORKING FACE REPAIR.

by 4 inches apart. Next, cut with a cross cut, the space between, ¾ inch wide and ⅜ inch deep. Mark out a piece of ⅜ inch bar iron to the same sizes with the exception of length, which should be ⅛ inch shorter. Make it red hot; it will then fit exactly, and by action of cooling will draw the cracked piece of machinery tightly together. File off any burs showing after which the job is repaired solidly and neatly, with exactly its original fit.

AN INTERESTING BOILER REPAIR.

By J. H. W.

THE twin-screw steamship "Canada," 11,440 tons, of the Austro-American line, is one of the largest vessels entering Montreal harbor during the present season. She is, moreover, one of the largest emigrant ships in the world, having accommodation for over 3,000 steerage passengers, together with a crew of 160.

The "Canada" is propelled by quadruple expansion engines fitted with Walschaert valve gear, and steam at 215 lbs. pressure is raised in four boilers of the Scotch type. Each of the latter has three furnaces, the two centre boilers being single-ended, while the port and starboard boilers are double-ended. On the ship's first voyage to Montreal from Trieste this season, she met with a mishap, which put the port boiler out of commission. She had a very light cargo on that trip, and was only drawing 13 feet forward and 21 feet aft, as against her normal draft of 30 feet when fully loaded.

The incident took place in the afternoon when off the Banks of Newfoundland. The "Canada" had on board 2,300 passengers, the majority of whom were on deck at the time. A strong north-easterly wind sprang up suddenly, and as there were numerous icebergs in the vicinity, this wind was very cold, causing the passengers to make a concerted rush to the lee side of the deck houses. This movement, combined with the strong wind, gave the vessel a bad list to port, with the result that the crown sheet of the starboard combustion chamber of the port boiler became overheated and collapsed.

There were three inches of water in the glass at the time, and directly the ship listed extra feed was given to all the boilers. At the same time the starboard tanks were filled as rapidly as possible in an endeavor to bring the ship again upon an even keel. These measures took about ten minutes, by which time the crown sheet of the combustion chamber in question had been badly burned. It collapsed in pockets between the staybolts, causing the holes

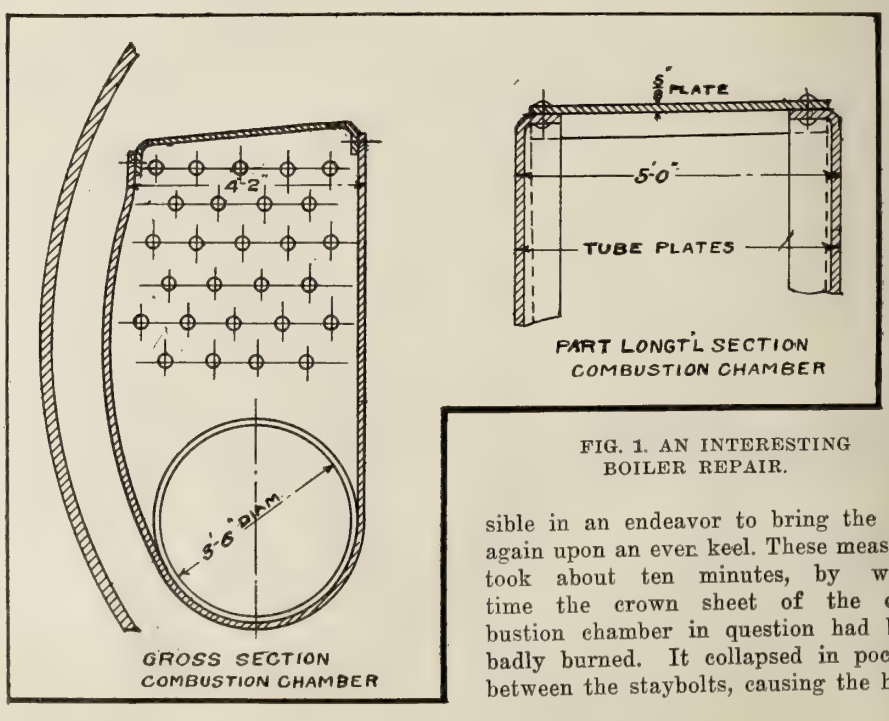


FIG. 1. AN INTERESTING BOILER REPAIR.

for the latter to become enlarged, although the bolts did not actually pull out. There was, however, a serious leakage of steam and water into the furnaces.

The ashpan and uptake dampers were immediately closed, and the fires drawn. The latter operation proved rather a difficult one owing to the escaping steam; but fortunately no one received injury.

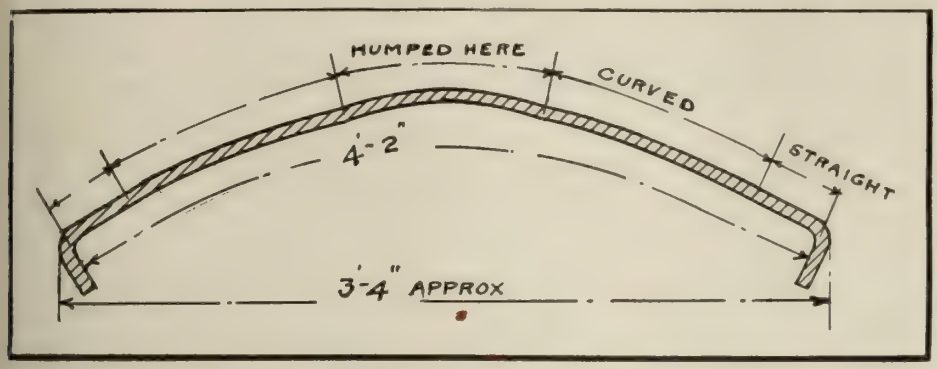


FIG. 2. AN INTERESTING BOILER REPAIR.

Making the Repair.

The voyage was continued with three boilers, and on Montreal being reached, repairs to the damaged combustion chamber were at once undertaken by the Hall Engineering Works of that city.

The combustion chamber top was 4 feet 2 inches wide by 5 feet long, and it was desired to have the new crown sheet made from a single plate, but the internal diameter of the corrugated furnaces was only 3 feet 6 inches; so that at first sight there s med to be no choice but to use two plates and have a riveted joint along the top of the chamber. Such a joint would, of course have been highly undesirable in such a location, and the manner in which the necessity for it was overcome is shown in the accompanying cuts.

The crown sheet, it should be mentioned, was ⅝ inch thick and of ordinary boiler plate quality—60,000 pounds tensile strength. It was flanged on two edges to make joint with the combustion chamber side sheets, as indicated in Fig. 1. In order to get it through the flue it was determined to roll it to a curve, as shown by Fig. 2. A piece of ⅛ inch plate was first taken and cut to the dimensions of the crown sheet. This plate was then flanged, so that it formed a true templet of the heavier plate. It was then put through a set of rolls and various trial curves given to it until it would pass easily through the flue. The curve did not extend the full width of the plate, a portion of the latter being left flat near each of the two flanges. A rather sharper radius was given along the longitudinal centre line than elsewhere, the general shape of the curve being shown in Fig. 2.

The templet having been satisfactorily shaped, the crown sheet was rolled to the same curvature. It was then transported from the Hall Engineering Works to the ship, where it easily passed through the furnace flue into the combustion chamber.

The next step was to raise the plate and place it upon the top of the forward tube sheet with the flanged edges in a fore and aft direction—that is, in a position at right angles to the direction they were to eventually occupy. This is shown in Fig. 3.

Straightening the Plate.

The plate having been got into the position indicated, stout timber struts were fitted between it and the boiler shell. These served to hold it securely while one half was gradually straightened out by hydraulic jacks. When this had been satisfactorily accomplished the plate was removed to a similar position on top of the other tube sheet, and the straightening operation repeated on the other half. The plate was practically straightened cold, it only having had "the chill taken off," in order to avoid the risk of setting up serious stresses in the metal.

All that now remained to do was to turn the plate round into its final position and drill it for the rivet and stay bolt holes. The rivets were then driven, the girder stays replaced, and, in just a week's time from the commencement of the job, the boiler was ready for steam again. Of course, work was carried on night and day; but, even so, the performance was a good one. Turning the plate around and afterwards straightening it were two very awkward operations in the cramped quarters afforded by the combustion chamber; and that the work was satisfactorily accomplished speaks well for the facilities to be found at the port of Montreal, and the resourcefulness displayed by and emergency equipment available at the Hall Engineering Works there.

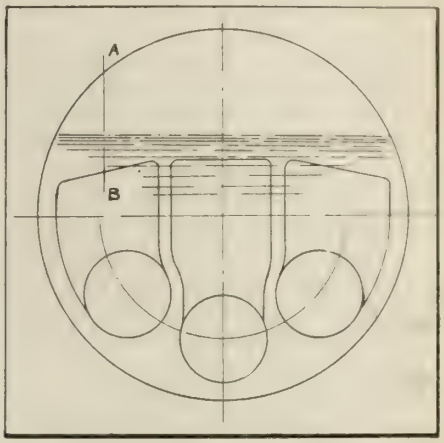


FIG. 4. AN INTERESTING BOILER REPAIR.

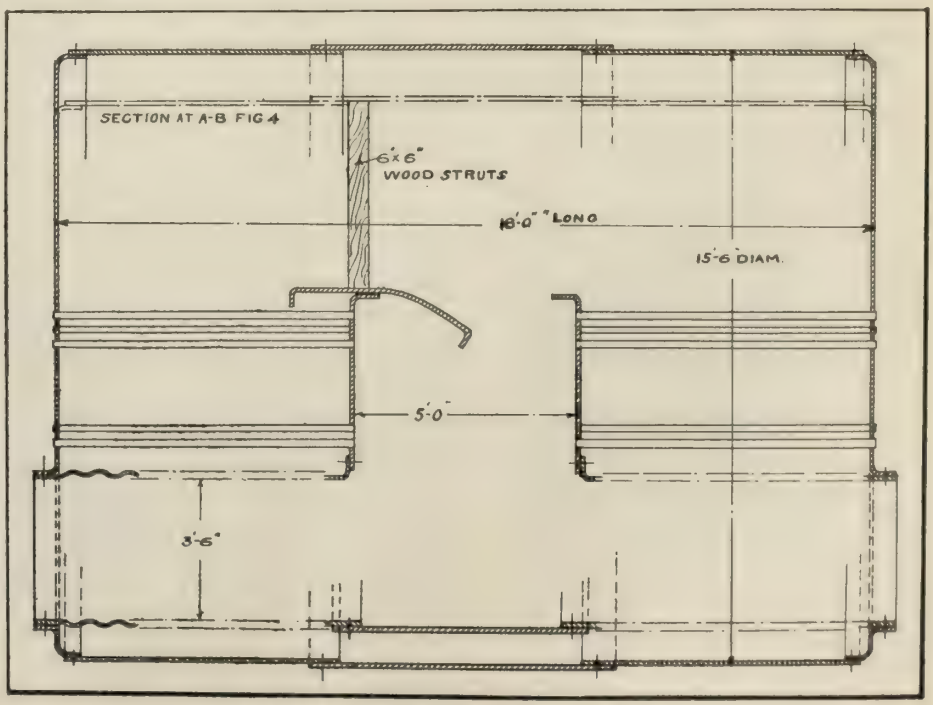


FIG. 3. AN INTERESTING BOILER REPAIR.

Practical Questions and Answers for Engineers

The present series of Questions and Answers will be departmental in their scope, it being our intention during the course of publication to have an equal number appear in each issue relative to two sections of power plant operation and practice. Comment and inquiry are invited.

REFRIGERATION.

Question.—On what principle does a refrigerating machine operate?

Answer.—You compress by means of external force a gas or vapor and extract its heat to diminish its volume. By causing the compressed gas or vapor to expand, you lower its temperature. Heat is again absorbed by the gas or vapor, and the latter resumes its original condition, constituting the refrigerating effect of the arrangement.

* * *

Question.—On what does the efficiency of a refrigerating machine depend?

Answer.—The efficiency depends on the difference between extremes of temperature.

* * *

Question.—On what does the useful effect of a refrigerating machine depend?

Answer.—It depends upon the ratio between the heat units eliminated and the work expended in compressing and expanding. This result is independent of the nature of the body employed.

* * *

THE STEAM BOILER.

Question.—What is the purpose of an economiser; of what does it consist; what are its possibilities to accident, and what precautions should be taken in its operation?

Answer.—The purpose of an economiser, as generally understood, is to absorb a part of the heat from the furnace gases after leaving the boiler, and previous to their entering the stack. It consists of a series of vertical cast iron tubes so placed in a flue between the boiler and chimney that the waste gases, in passing, heat the feed water which is pumped through the tubes on its way to the boiler. The principal dangers are: Failure of tubes, due to external wasting caused by condensation of moisture in the gases at the lower end of the tubes when cold feed water is used, and straining caused by incrustation within the tubes; failure of the bolts securing access caps; flue gas explosions; and over-pressure due to overloading safety valves, or to the economiser being exposed to heat when the feed water is not passing through the tubes. The following precautions should be adopted:—The temperature of the feed water should not be less than 90 degs. F., or, in cases where steam is blown into the furnaces, 100 degs. to 110 degs. F., otherwise the vertical tubes and bottom boxes are liable to corrode owing to condensation of the vaporous portion of the furnace gases, and rapidly if the fuel contains much sulphur. By connecting a ¾-in. wrought-iron pipe between the hot-water outlet from the economiser and the suction side of the feed pump, at each stroke of the latter a small quantity of hot water is drawn into the cold feed and the chill taken off. The required supply of hot water is regulated by a small tap in this pipe. For large economisers, another method consists in passing hot water from the hot end of the economiser to the cold end by means of an independent centrifugal pump. Corrosion from this cause may also be confined to a few tubes by arranging the economiser in sections, and circulating the feed water from section to section. Scale within the tubes should not be allowed to exceed ⅛ in., as it is liable to strain them. Any accumulation of scale should be bored out. Under no consideration should bolts, nuts or joints be tampered with whilst the economiser is under pressure, particularly those securing the external lids on top boxes and oval flanges on branch pipes, and they should be carefully examined from time to time. This danger does not arise with internal top box lids, and the risk of danger is much reduced at the branch pipes if round flanges with four bolts are used instead of oval flanges secured by two bolts. Silicate cotton, slag wool, hair, felt or asbestos should be used as a covering in preference to composition, to allow easy examination of top boxes, lids and lid bolts, as leakages and corrosion may take place undetected. Explosion and firing of flue gases can only be prevented by avoiding pockets in the flues where unburnt gases can lodge, and by establishing a draught before the fires are broken up. If, in any particular case, these precautions fail to prevent explosions, it is highly desirable to have explosion flap doors fitted. The attendant should be carefully instructed to study the proper manipulation of the dampers and valves under different conditions so as to prevent excessive heating when water is not passing through the economiser. When raising steam, or during the night or at meal times, the outlet valve between the economiser and boiler should not be closed, and the reserve flue damper must be kept open until the engines are started. When shutting down the economiser for repairs or any other purpose, the reserve flue damper should first be opened, then the inlet and outlet economiser dampers should be closed; the direct boiler feed valve should then be opened and the inlet and outlet economiser feed valves closed. The economiser dampers must be properly closed; if kept partially open by accumulation of soot in the flues, this may lead to a serious explosion. Under ordinary working conditions the boiler should be fed constantly. The boiler feed valves should be kept open and the feed regulated as far as possible by the inlet valve to economiser so as to give a constant feed. Safety valves should not be overloaded. Waste water from valves should not be allowed to drain into the soot pit, flues or cleaning space, and any indications of damp should have prompt attention. Economisers fixed in exposed positions and standing idle should be emptied during frosty weather. Hydraulic tests should be applied periodically, and, in such tests, the economiser should be slowly filled with water to avoid air pockets.—Buchan.

* * *

Question.—What is the purpose of a super-heater when installed in connection with a steam boiler- Of what does it usually consist, and what precautions have to be taken to prevent trouble and maintain the apparatus at its highest efficiency?

Answer.—Superheaters are used to dry the saturated steam by increasing its temperature. They usually consist of a series of tubes through which the steam passes on its way to the engine, and are heated either by independent fires or by the hot gases in the boiler flues. When superheaters are independently fired, no difficulties arise beyond those peculiar to water-tube boilers, but when they are exposed to very high temperatures in boiler flues, it is customary, when getting up steam, to flood them with water in order to prevent overheating. In these circumstances, it is important to ensure that the superheater is thoroughly drained before the main stop valve is opened, otherwise there is great danger of water being carried into the steam pipes and setting up water-hammer. As the tubes of superheaters may become considerably weakened by overheating or by the scouring action of the fine particles in the flames, all superheaters, as in the case of water-tube boilers, should be subjected to periodical hydraulic tests.—Buchan.

PROGRESS IN NEW EQUIPMENT

There is here provided in compact form a monthly compendium of the power plant manufacturers' achievements.

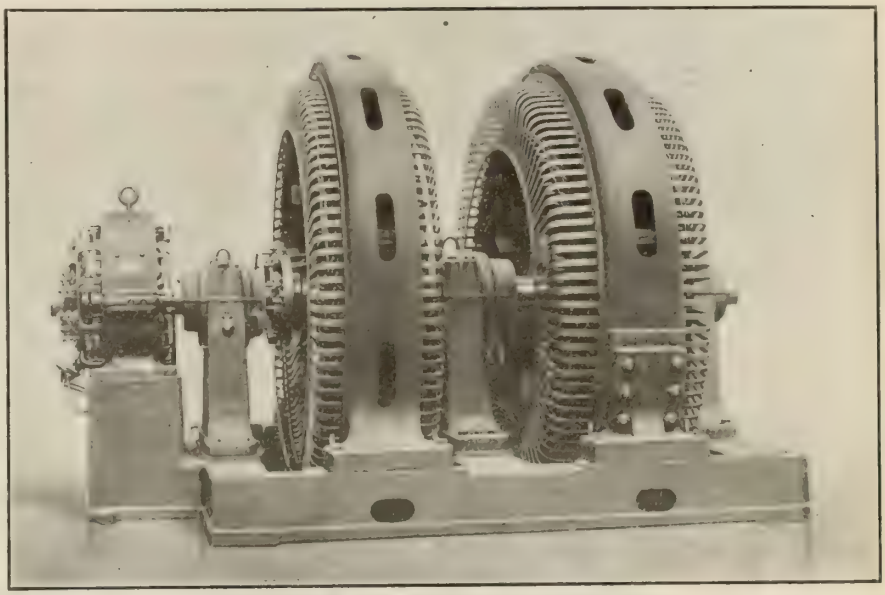
SYNCHRONOUS FREQUENCY CHANGER SETS.

MANY operating conditions require the conversion of electrical energy from one frequency to another, and an economical and efficient means of accomplishing this is by means of frequency changers. Some of the special features of these Westinghouse Electric sets are that their design embodies space economy. They are self-starting, and the stators of both motor and generator are mounted on a common bedplate, being as close together as mechanical clearance and ventilation requirements will permit. The rotating parts of both machines are mounted on a common shaft. A pedestal bearing is ordinarily mounted on a "bridge," as illustrated in Fig. 3, and in case of repairs, this bridge can be quickly removed and the stator easily slid to one side along the bedplate, to allow ready access to either stator or rotor.

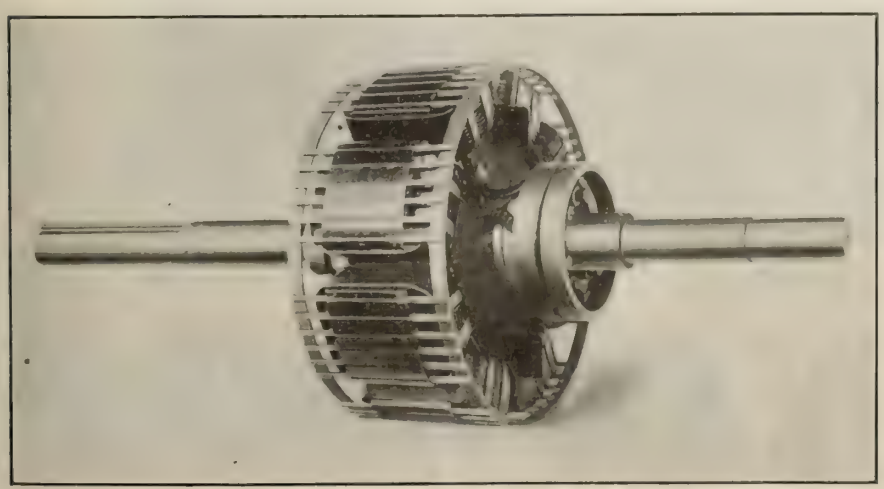
If conditions require two or more synchronous sets to operate in parallel, the rotors of all generators must bear the same phase relationship on their respective shafts. It is not practical to set these rotors with sufficient accuracy during the process of manufacture. One stator is, therefore, set in a "cradle," which permits of sufficient rotation to obtain a proper alignment, as illustrated in Fig. 2. This adjustment has to be made only when starting up the sets for the first time, and thereafter their relative locations do not change.

The stationary frames are made of strong, rigid iron castings, into which soft steel laminations are dovetailed and securely fastened. Ventilating ducts are spaced at frequent intervals across the face of the armature punchings. The armature coils are vacuum dried and impregnated before the outside insulation, consisting of wrappings of mica and paper on the straight portions of the coils which lie in the slots, and servings of treated cloth over the V-shaped coil ends is applied.

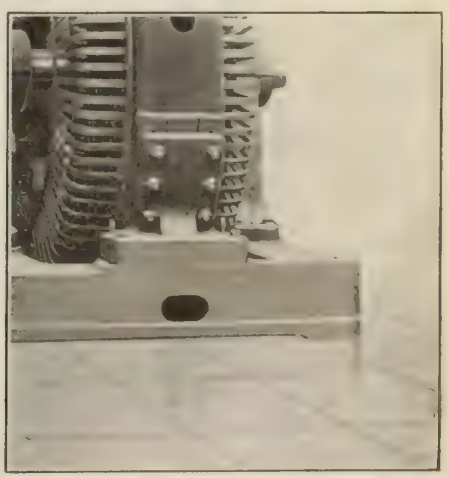
A rugged spider is used, to which field poles, built of thin steel laminations riveted together, are either bolted or dovetailed, as required by the speed of set. These poles have overhung tips provided to support the field poles, which are built up of heavy copper strap



SYNCHRONOUS FREQUENCY CHANGER SET.

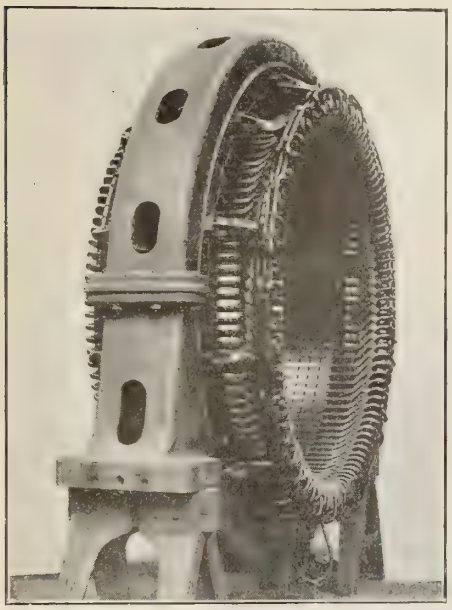


SYNCHRONOUS FREQUENCY CHANGER SET DETAIL.



SYNCHRONOUS FREQUENCY CHANGER SET DETAIL.

wound on edge, and insulated in such a manner that the individual turns are each exposed to the air for ventilation. The bearings of these standard frequency changers are self-oiling and built of cast iron shells of ample size, split horizontally to allow ready removal, and lined with grooved babbitt. They are fitted with oil rings, which carry the oil



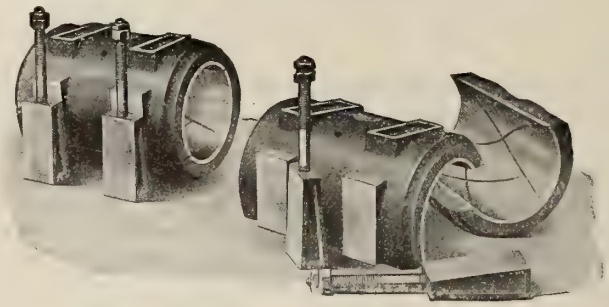
SYNCHRONOUS FREQUENCY CHANGER SET DETAIL.

from a well in the bottom of the shell to the shaft. The shaft is provided with oil-throwers and catchers. Covered openings in the upper shell facilitate inspection of the oil rings.

The selection of a set to be used for each installation is worthy of careful consideration. A high-speed set is generally somewhat cheaper than a low-speed one, but may not give the exact frequency ratio required. The synchronous type has certain advantages which render it the almost invariable choice, but there may be cases where an induction set would be preferable. The synchronous set is slightly more efficient. It permits of operation of the motor at unity power factor, its point of highest efficiency, or by slightly increasing the capacity, at a leading power factor, and thus obtaining a corrective effect which is often desirable. The synchronous set can at slightly increased expense be made reversible.

The synchronous set is at a disadvantage when of relatively small capacity and required to tie two much larger generating systems together. In this case, the speed of one system must always have the same relation to the speed of the other system, and any change on one must be transmitted through the set, and the frequency changer supply the power necessary to bring the speed of the other system to its corresponding value—enabling heavy overloads to be imposed on the set. Here the induction outfit, with some variation in slip possible, may be the proper machine.

A direct-connected exciter can be supplied, mounted on either motor or generator end of the set, and of capacity to furnish either motor or generator, or both, with the necessary excitation. When variable loads are likely to be encountered, and an automatic regulator is used, separate exciters for motors and generator are usually preferable, inasmuch as a common exciter would necessitate constant attention in order to control the power factor of the motor. All sets are carefully inspected during each step in the process of manufacture and before each succeeding operation is started. When completed they are tested under conditions as nearly identical as possible to those which future service will demand.



MAIN BEARINGS, ROBB CORLISS ENGINE.

THE ROBB CORLISS ENGINE.

THOSE who have wanted to profit from the economy of a Corliss engine but have hesitated to install this type because its speed is too low, especially for driving a generator direct-connected, may be interested in the Robb Corliss engine. With shorter stroke, much higher speed, positive operation of valves, and complete enclosure of moving parts this type overcomes many objections to the old forms of the well-known Corliss engine, yet at no sacrifice to the usual advantages of this valve gear—almost perfect steam distribution, independent adjustment of the events of the stroke, small clearance, and separate cylinder ports for admission and exhaust which reduce cylinder condensation.

TANDEM COMPOUND, ROBB CORLISS ENGINE, TYPE "F."

Speed.

Successful operation at speeds from 90 to 225 revolutions per minute is claimed to be the principal advantage resulting from the modified Corliss valve gear as used in the Robb engine. This high speed is made possible by simplifying

the valve gear so as to eliminate all springs, dash pots, latches, cams, and disengaging parts.

In addition to the higher speed, the absence of these delicate parts means a smooth running engine, and so little wear on the valve gear that steam economy and good regulation are maintained indefinitely. The economy does not fall off rapidly after a short period of operation because the valve is not under the strain caused by the continual lifting of dash pots; and the valves cover the ports so firmly and seal them so tightly that there is no chance for leakage.

In other respects the Robb Corliss type is designed on the lines of modern heavy-duty Corliss engines.

Valves.

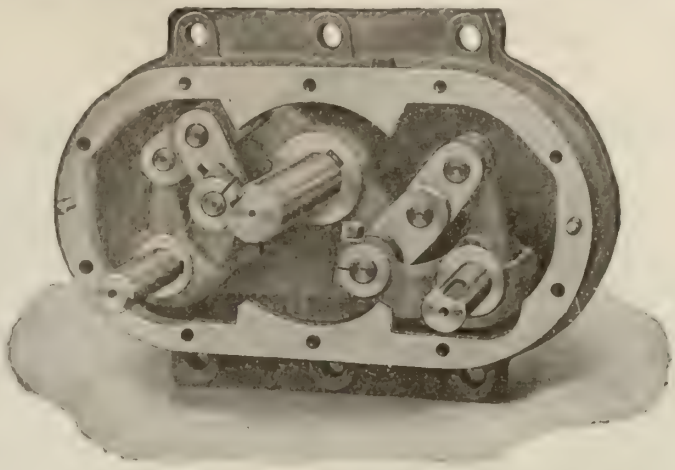
Full pressure of steam gets quickly into the cylinder of the Robb engine because of the triple port opening through the admission valves; and there is free exit through the exhaust valves at the proper time because of the double port opening. The steam pressure is well taken care of by the large surfaces of the valves which are nearly balanced by carrying the metal around the top, resulting in long life and minimum wear of valves and seats.

Accurate machining of the ports is possible because the valve seats are separate bushes, machined before being put in place.

Valve Gear.

A valve action that does not depend upon a releasing gear for quick opening and closing is a distinct feature of the Robb Corliss engine, yet the motion imparted to the valves is identical with that of drop-cut-off gears which pick up the lifting arms, and then drop them. Two small links between the wrist plate and bell crank do away with springs, dash pots, latches, and cams, making a positively-driven valve gear which may be operated at high speed.

The valve gear is positive. It does not let go of the valves, but with positive action opens them quickly, closes them promptly, and holds them stationary during the closed period, which is over half the time, and constitutes that period when the unbalanced pressure between the steam pipe and the cylinder would cause friction. Elimination of many working parts, all latches and detachable pieces gives a smoother running gear, with fewer surfaces subject to wear, and a gear quite noiseless, even at high speed.



VALVE GEAR CASING, WITH COVER REMOVED.

The greater possibilities of high-speed Corliss engines, especially the driving of generators direct-connected, call for the use of a positive valve gear which fulfills every requirement for this class of difficult work, while enclosing the valve gear in a tight casing, so that all working parts are in a bath of oil, reduces to a minimum the friction and wear detrimental to releasing gears.

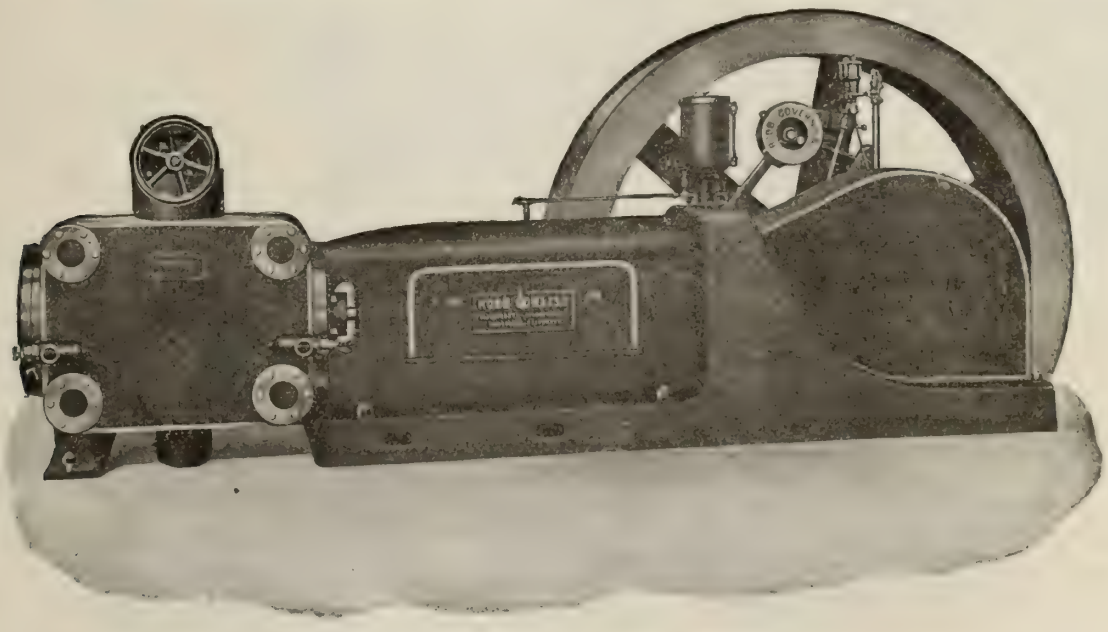
Eccentrics.

A more desirable and economical steam distribution is possible with the double eccentric arrangement as it permits of an independent setting of exhaust valves for release and compression. Two eccentrics are used in the Robb Corliss engine, one forming a part of the governor and controlling the steam valves, and the other operating the exhaust valves through a wrist plate in the usual way.

Governor.

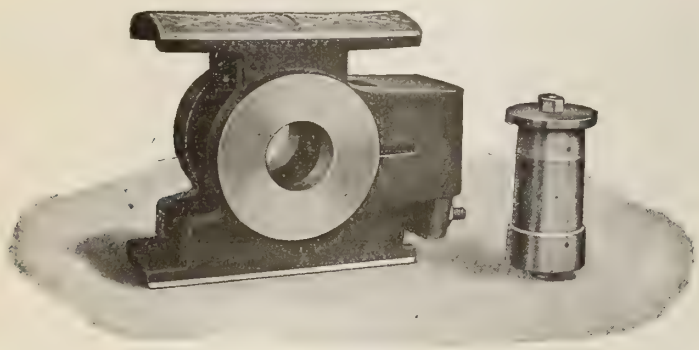
Cut off is controlled by the Robb Governor which is a modification of the Sweet shaft governor. It is located in the fly-wheel of the engine, and drives the valve gear and controls its operation. It gives positive quick action, with closer regulation than the indirect method of governing.

Simplicity and power are combined by

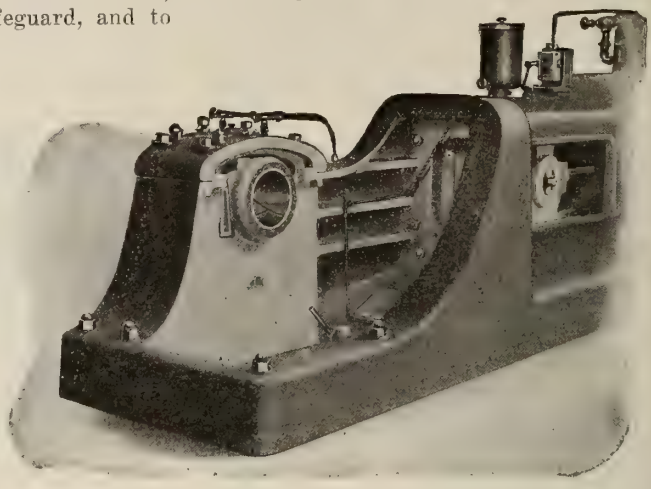


SINGLE CYLINDER, ROBB CORLISS ENGINE.

reducing the number of main parts to three, and carrying the centrifugal weight upon a spring entirely independent of any bearings. The heavy strain caused by centrifugal force is not brought on the suspension pin because it merely carries the eccentric and drives the valve gear. Under these conditions, it is easily lubricated for long periods. In all positions the governor is in gravity balance, because the eccentric balances the centrifugal weight. Disturbance by the reciprocating motion of the valve gear is prevented by the inertia of the weight, and quick regulation is obtained by placing the weight so that it gets sufficient effect from inertia.



CROSSHEAD, ROBB CORLISS ENGINE.

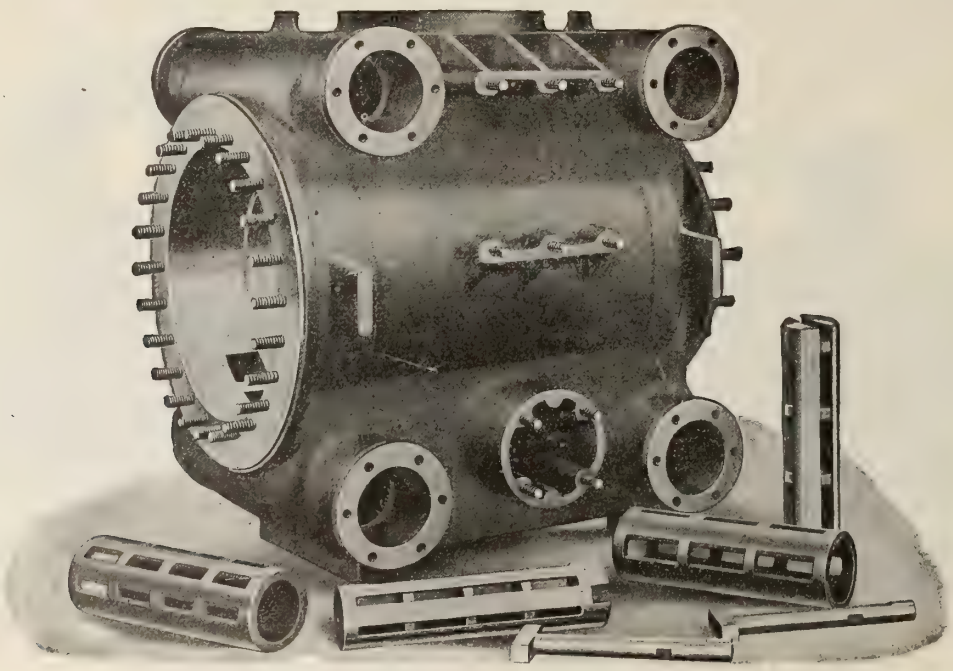


CRANK END OF BED SHOWING OIL PIPING, ROBB CORLISS ENGINE.

Lubrication.

In common with most up-to-date engines, the moving parts of the Robb Corliss engine are completely enclosed, affording ample protection for the moving parts and cleanliness of both engine and engine room. The bed castings are so arranged that the oil is retained and carried to the crank pit, and from this point it is distributed to all the bearings of the engine by means of an oil pump driven from the crank pin.

Positive lubrication is thus assured, but as an additional safeguard, and to provide for any emergency, an oil reservoir is mounted on top of the engine ready for immediate use in case anything should go wrong with the oil pump. In this way, the system of lubrication is practically duplicated. The pressure is kept constant by the relief valve in the oil piping. Cylinder lubrication is provided by a sight feed lubricator, and by a positively-operated power pump of approved design with oil pipes leading to the cylinder at the proper points.



CYLINDER, VALVE AND BUSHES OF ROBB CORLISS ENGINE.

Balance.

The reciprocating parts are balanced for running conditions by properly counterweighting the cranks and setting the valves to give correct compression to cushion the reciprocating parts at the ends of the stroke.

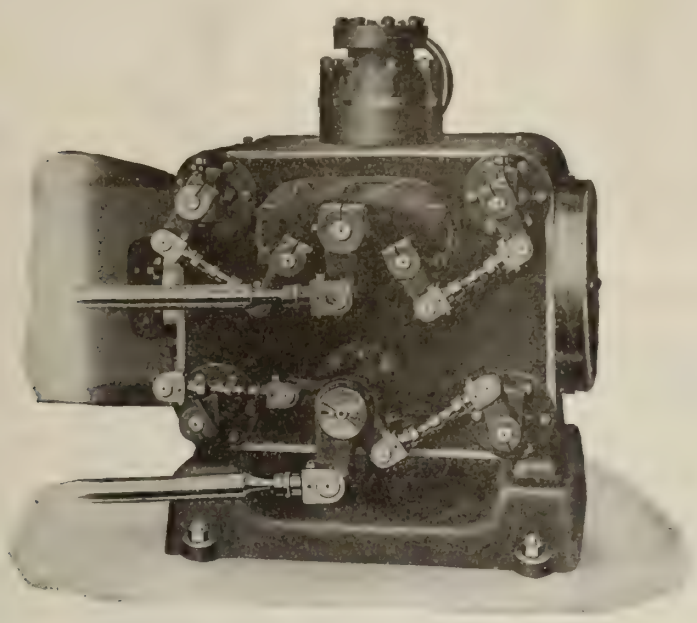
General.

To obtain that much desired combination in engine building, constant operation day after day without attention, minimum upkeep, and economy in both steam and oil,—builders must use heavier designs and provide for higher speeds and greater pressures. Saving of floor space also is a feature that must not be lost sight of when all-round efficiency is desired; nor can cleanliness of engine room be neglected when designing an engine for the up-to-date power plant.

It has been customary to consider the Corliss type of engine efficient as regards low steam consumption, but it is as freely admitted that the usual forms do not have the compactness that comes from short stroke and high speed, nor are they often enclosed. The relatively long stroke and low speed of the older Corliss engines require a large floor area by themselves, and the amount of room

taken up is still greater when they drive electric generators by belts.

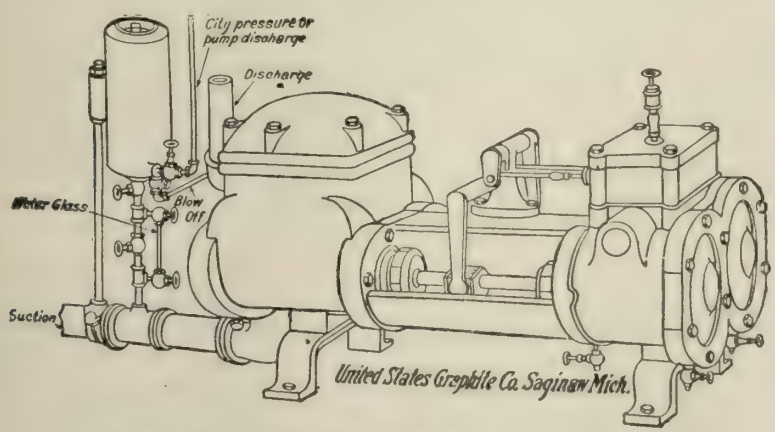
If the generator armature is placed on the engine shaft in order to save some floor area, its speed is necessarily so low that the generator is very large and therefore expensive.



VALVE GEAR, ROBB CORLISS ENGINE.

FEEDER FOR BOILER GRAPHITE.

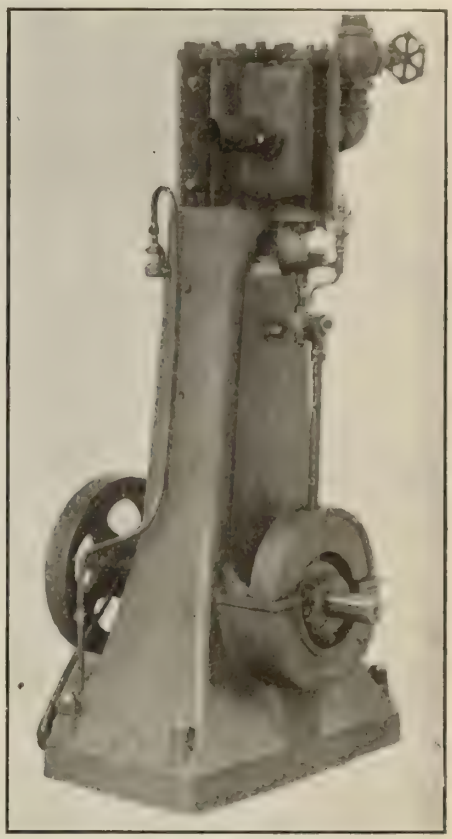
THE illustration shows a graphite feeder which is recommended by the United States Graphite Co., of Saginaw, Michigan, to accomplish a steady, gradual feed. This feeder has a reservoir so equipped with valves that it may be entirely closed and all water pressure shut off. The water valve is then opened so that the ordinary city water pressure is applied to the reservoir of the feeder, and then this combination of water and graphite is fed through an outlet valve at the bottom of the reservoir into the feed water on to the suction side of pump. The valve permitting the water saturated with graphite to pass through can be readily adjusted by watching the water glass to see how fast it is traveling. With a little experience, the engineer is soon able to regulate the valve so that there will be, through the hours of operation, a constant leeching of graphite going into the boiler with the feed until the contents of the reservoir become exhausted when the valves are again closed, and by means of a drain valve which is on the reservoir, it is emptied of the clear water remaining, and again filled with graphite and regulated as before. After a little experience and measuring of time the valve through which the graphite passes into the feed water can be set and marked so that the engineer will know just where to open it each time in order to give his dose as specified. The illustration shows the manner in which the feeder is connected with the feed line at the suction side of pump.



BOILER GRAPHITE FEEDER ARRANGEMENT.

SINGLE CYLINDER ENCLOSED TYPE VERTICAL ENGINE.

THE International Engineering Works, Amherst, N.S., have recently brought out a new design of Robb vertical enclosed engine, intended for direct connection to small electrical generators, fans, and for other purposes requiring small power. The cut shown is taken from one of these engines arranged for direct connection to a fan. The engines are completely enclosed, and are fitted with forced lubrication supplied by an oil pump driven from the shaft. They are well suited for small electric light plants and for the lighting of steamboats, as well as for all general purposes. They are built upon the interchangeable system, so that duplicate parts can be supplied from stock at any time, and are of a very neat and serviceable design.



SINGLE CYLINDER ENCLOSED TYPE VERTICAL ENGINE.

INSPECTION OF MACHINERY.

IN New Zealand all steam boilers, other than Government railway locomotives, must be certified to be safe for work by the Inspection of Machinery Department every year, and in its annual report to Parliament, the Department states that, during the past year, 7,011 boilers were examined, and that, in 1,239 cases, defects were discovered, of which 33 were very dangerous. The new boilers registered during the year numbered 587, with a total of 6,649 h.p.

POWER PLANT DEVELOPMENTS

A record of current municipal, manufacturing and general industrial projects, involving steam, gas, oil, electricity, air and water power equipment requirements.

Electrical

Rainy River, Ont. — New equipment has been purchased for the power house here.

South Vancouver, B.C. — The city council will go ahead with the building of a civic power plant.

Prince Albert, Sask.—The ratepayers have authorized the expenditure of $275,000 for a new steam power plant.

Smith's Falls, Ont.—The Smith's Falls Electric Power Co. have installed a 400 h.p. generator, which will more than double their lighting capacity.

Alberni, B.C. — The Ritchie-Agnew Power Co. will instal equipment of 250 h.p. capacity, costing $75,000 at Stamp Falls, and later will add a plant of 25,000 h.p. capacity, costing $2,000,000. This is contingent on the town of Alberni agreeing to buy power for 30 years at a little over 2 cents per k.w.h.

Welland, Ont.— Another 60,000 volt line has been started from Niagara Falls for the use of the Welland Hydro-Electire Commission. It has a capacity of 50,000 h.p., of which 25,000 horse-power has been sold to the Carbide Works and Turnbull's electric steel works, which are just beginning to erect plants here.

St. Thomas, Ont.—The Michigan Central Railroad signed a contract with the City of St. Thomas on Sept. 24 to use Hydro-Electric. The road agrees to take 670 horse-power, with the privilege of using 1,200 horse-power. It is expected when the company have their new shops completed, that they will be using 1,000 horse-power. The city is now negotiating with the Pere Marquette Railroad for a contract.

Refrigeration

Saskatoon, Sask.—The Saskatchewan Abattoirs, Ltd., capitalized at $200,000, will shortly erect a plant.

Winnipeg, Man.—The Board of Control has awarded the contract for the construction of a refrigeration plant, to cost about $12,000.

St. John's, Nfld. — Two Norwegian gentlemen were here recently to establish a refrigerating plant, with the intention of exporting halibut, salmon and eels.

Lethbridge, Alta.—The United Farmers of Alberta are interested in a proposition to erect a co-operative pork packing plant to handle 50,000 hogs annually. Secretary, P. P. Woodbridge.

The York Manufacturing Co., York, Pa., makers of ice-making and refrigerating machinery, have recently supplied the following equipment: Manitoba Agricultural College, Fort Garry, Man., one 4-ton vertical single-acting belt-driven enclosed type refrigerating machine and high pressure side complete. Joseph Kilgour, Toronto-to, Ont., one 4-ton vertical single-acting belt-driven enclosed type refrigerating machine and high pressure side complete. Ottawa Dairy Co., Ottawa, 3,615 feet of 1¼ in. direct expansion piping for bunker coils.

Trade Gossip

Transformer Order. — The Hydro-Electric Power Commission of Ontario have placed an order with the Canadian General Electric Co., Limited, for six transformers, each 3,500 k.w., 46,000-2,300 volts.

Electric Motor Contract.—The Donnacona Paper Co. of Donnacona, Que., has ordered electric motors ranging from 150 h.p. downwards, and aggregating 1,330 h.p. from the Canadian General Electric Co.

Motor Order.—The Abitibi Pulp and Paper Co. has placed with the Canadian General Electric Co. an order for electric motors, ranging from 400 h.p. downwards, and aggregating 2,165 h.p. for their new mills at Iroquois Falls, Ont.

The Toronto Electric Light Co. have recently purchased 2,200 h.p. of Riley Self-Dumping Underfeed Stokers, to be used in a stand-by steam station as a reserve for the power from Niagara Falls. The above type stoker was described and illustrated in the April, 1913 issue of our journal, The Power House.

F. Reddaway & Co., Newark, N.J., have appointed The A. R. Williams Machinery Co. to act as exclusive selling agents for the "Camel Hair" belting in Toronto and West to the Pacific Coast, also that complete stocks of "Camel Hair" belting are now being carried by the A. R. Williams Co. in Toronto, Winnipeg and Vancouver.

Morrisburg, Ont.—From the judgment of Hon. Mr. Justice Hodgins, Judge in Admiralty of the Exchequer Court, Toronto district, an appeal is to be made to the Supreme Court of Canada in connection with the barge Huron, which was wrecked here and its cargo destroyed in August of last year. Judge Hodgins gave judgment for $22,387 with costs in favor of the Montreal Transportation Co.

C.N.R. Tunnel Electrification.—The Canadian Northern Railway Co. has just placed with the Canadian General Electric Co., Ltd., an order for the complete electrification of its tunnel under Mount Royal and of its terminals on Dorchester Street in Montreal. The contract, which amounts to about $500,000, includes seven locomotives, multiple unit cars, generators, switchboards and other auxilliary apparatus.

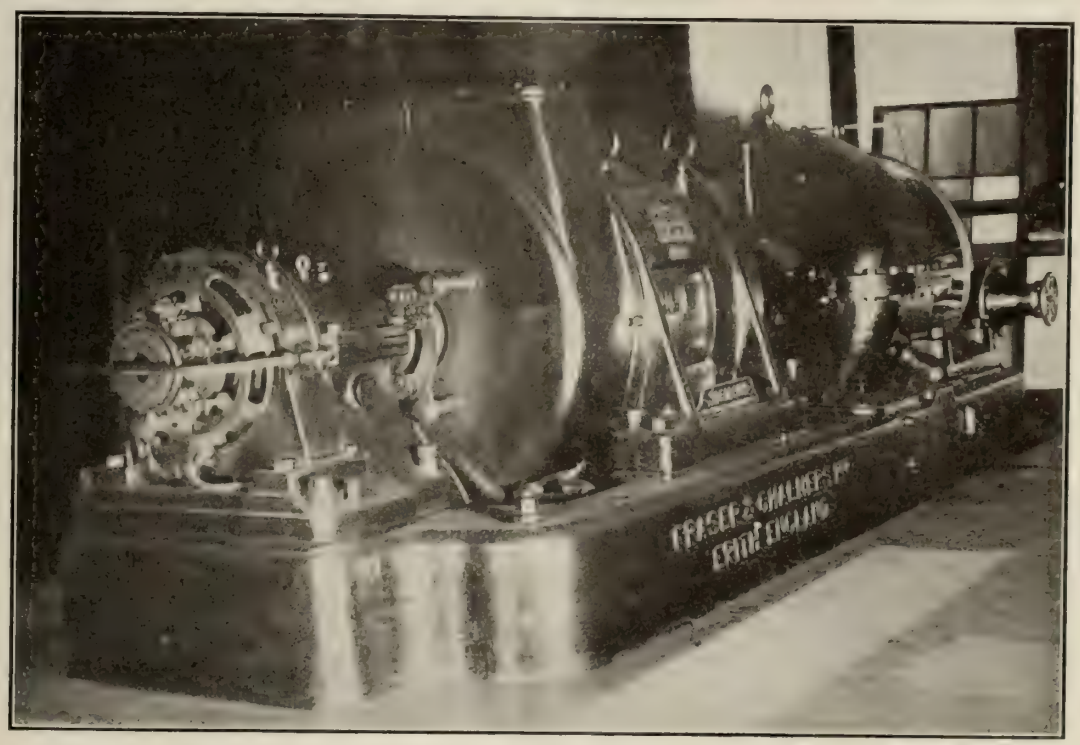
Boiler Inspection Certificates. — A number of boiler manufacturers, etc., attended the Parliament buildings recently with the hope of eliciting the opinion of the Ontario Government in regard to reciprocity of boiler inspection certificates between the various provinces. They declared that much needless trouble and expense is incurred under the present conditions, and that one provincial inspection should meet the demands of all concerned in the business. Other Provincial Governments will be approached in the near future.

Railroad Electrification.—If we bear in mind the many difficult problems and the great cost involved in changing from

SIEMENS BROS. DYNAMO WORKS | SIEMENS BROS. & CO.

SIEMENS

SIEMENS - SCHUCKERTWERKE | SIEMENS & HALSKE



Siemens 750 K.W., 3600 R.P.M. Turbo Generator supplied to the Nova Scotia Steel & Coal Company Nova Scotia.

The following Siemens Turbo Generators have been supplied or on order for Canada:

1—4,000 K.W. Edmonton.
1—2,500 K.W. Dominion Coal Company.
3—2,000 K.W. Dawson City.
1—2,000 K.W. Edmonton.
2—1,500 K.W. Regina.
1—1,500 K.W. Lethbridge.
1—1,500 K.W. Moose Jaw.
1— 750 K.W. Nova Scotia Steel and Coal Co.
2— 750 K.W. Medicine Hat.
2— 500 K.W. Nova Scotia Steel and Coal Co.
1— 500 K.W. Wayagamack Pulp and Paper Co.

The Siemens Companies have supplied more than 100 Turbo Generators of 4,000 K.W. or over.

Siemens Company of Canada, Limited

HEAD OFFICE:

Transportation Building - MONTREAL

BRANCH OFFICES:

STANDARD BANK BUILDING
TORONTO

McARTHUR BUILDING
WINNIPEG

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steam to electric operation on railways, it must be admitted that great strides have been made in this direction. A recent estimate places the total number of miles of single track that have been changed from steam to electric operation in the United States at about 1,600 miles, and the same authority finds that approximately 1,500 miles of single railway track will probably be subjected to the same change during the next few years.

Pigeon, Pigeon, & Davis, patent solicitors, 714 St. James Street, Montreal, report that 94 Canadian patents were issued during the week ending August 26th, 1913, of which 64 were granted to Americans, 18 to Canadians, 8 to residents of Great Britain and Colonies, and 4 to residents of Foreign Countries. Of the Canadians who received patents, 7 were residents of Quebec, 7 of Ontario, 2 of Manitoba, and 2 of British Columbia. In the United States, for the same week, 666 patents were issued, of which 10 were granted to Canadian inventors.

Electric Pumping Plant.—The Canadian Collieries (Dunsmuir) have decided to instal an extensive electrically driven pumping plant. There will be four separate units. Two will be driven by 75 h.p. a.c. motors and a third by a 75 d.c. motor, each unit being capable of delivering 350 gallons per minute against a head of 370 feet. The fourth unit, consisting of two pumps working in series, will deliver 350 gallons per minute against a head of 740 feet. The pumps will be built by the Canadian Allis-Chalmers, Ltd., and the motors by Canadian General Electric Co.

The Nova Scotia Steel & Coal Co., New Glasgow, N.S., are installing nine 316 h.p. Fulton water-cooled mechanical stokers, which are being supplied and erected by the Hare Engineering Co., Toronto. The Canadian Locomotive Co. of Kingston, Ont., are changing over from oil furnaces to stoker fired furnaces as a result of their investigating the relative economy of coal fired and fuel oil fired boilers. This equipment is also being supplied by the Hare Engineering Co. The Montreal Rolling Mills Co., a branch of the Steel Company of Canada, are installing a Fulton stoker-fired furnace in their nut and bolt plant. This is a fifth or sixth repeat order.

Contracts Awarded

Winnipeg, Man.—The Imperial Wire & Cable Co., Montreal, received an order recently from the City of Winnipeg, for 12,000 ft. paper insulated lead covered underground cable.

Can. Crocker-Wheeler Co.—The contract has been let to the Canadian Crocker Wheeler Co., of St. Catharines, Ont., for motors and electric apparatus for the G.T.P. shops Transcona. The contract price is $26,500.

Toronto, Ont.—A contract has been awarded the Imperial Wire & Cable Co., Montreal, by the Toronto Hydro-Electric System for approximately 22,000 ft. of 2 and 3 conductor paper insulated lead covered underground cable and conductors ranging from No. 6 B. & S. to 500,000 C.M.

Calgary, Alta.—The City of Calgary have recently placed an order with the Imperial Wire & Cable Co., Montreal, for lead covered paper insulated underground cable. Approximately 40,000 ft. will be installed by the city under the supervision of R. A. Brown, City Electrical Engineer.

Ottawa, Ont. — The City of Ottawa have placed an order with the Imperial Wire & Cable Co., Montreal, for the supply and installation of 47,000 ft. 3 conductor No. 2-0 B. & S. paper insulated lead covered cable, and 1,100 ft. 3 conductor No. 2-0 B. & S. steel taped able, both insulated for 3,300 volts.

Catalogues

Series Luminous Arc Lamps are described in bulletin No. A-4035 published by the Canadian General Electric Company, Toronto. A full description is given of the lamp and photographs of streets where they are installed, demonstrating their illuminating capacity. Some illumination curves are also included.

"Unilets" is the title of a pamphlet being distributed by Chapman & Walker, Toronto, and which describes a line of steel fittings for electrical conduit work. Each type and size of the "Unilets" fitting is illustrated and numbered so that orders may be placed without difficulty. Copies may be had on application.

"Curtis Steam Turbines" is the title of a handsome bulletin which the Can. General Electric Co. have sent us. The bulletin contains a general description of the Curtis turbine together with excellent photographs of several installations and also of details showing some special features of construction. Copies of this bulletin No. A-4137 may be had by writing.

Hamilton, Its History, Commerce, Industries and Resources, is the title of a handbook isued under the auspices of the city council in the Centennial Year, 1913, a copy of which is in our hands. Suffice it to say that this work is bound and printed in the excellent way that is characteristic of most publicity literature sent out by this city. As a history of Hamilton there has not been anything like it published heretofore.

"Electricity on the New York Central" is the title of an interesting booklet published by the Can. General Electric Co., Ltd., Toronto. This booklet contains a brief description of the new terminals of the New York Central Ry. in New York and also particulars of the trains, power plants, substations, illumination, etc. Some excellent photographs are included showing the above.

The Canadian Allis-Chalmers, Ltd., Toronto, have sent us section (A) of a bulletin on the "Cochrane" separators, which are made by the Harrison Safety Boiler Works, Philadelphia, Pa. The separators described in this bulletin are designed for live steam and for various pressures. Each type and size are illustrated together with tables giving the principal dimensions. The benefits to be derived from installing separators are dealt with fully. Copies may be had by writing this company.

Comparative Tests of Belts With and Without Cling-Surface is the title of a bulletin written by Robert Thurston Kent, M.E., and published by the Cling-Surface Company, Buffalo, N.Y. The bulletin contains a description of a series of tests on belts, with "Cling-Surface" applied, conducted by Mr. Kent. The tests were of an exhaustive nature and much interesting data was obtained. Several curves were plotted, these being published in the bulletin. Copies may be obtained from A. Eugene Michel, 233 Broadway, New York City.

Notes on Electric Lifts is the title of a handsome catalogue which we have received from Smith, Major & Stevens, Northampton, Eng. A detailed description with illustrations is given of the principal features embodied in the design of the elevators made by this firm, a special feature being made of the automatic control elevator. The catalogue also contains some excellent photographs of buildings where these elevators have been installed. Gorman, Clancy & Grindley, Ltd., Edmonton, Alta, the Canadian representatives, will be pleased to mail copies on request.

The Bawden Machine Co., Ltd., Toronto, have sent us a copy of their new catalog No. 10 describing the well-known "Bawden" simplex steam pump which they manufacture. The special features embodied in the design of this pump are fully described together with diagrams showing the patent

"Cyclone" with Norivet Head

To Reduce Operating Expenses

Keep your boilers CLEAN and FREE FROM SCALE and you will get the full benefit of ALL YOUR FUEL.

A LIBERTY TUBE CLEANER will remove the scale THOROUGHLY in LESS TIME and at LESS EXPENSE than ANY OTHER TUBE CLEANING DEVICE. It will stand up under the most STRENUOUS WORK and still be doing efficient service, after competing machines have been consigned to the scrap pile. If you don't believe this, let us send you a machine TO PROVE IT. Don't take our word for it, but let the machine talk for itself. A demonstration with a LIBERTY cleaner is more eloquent and convincing than any statement made in its behalf.

Write for catalog.

Liberty Manufacturing Company

6904 Susquehanna Street **PITTSBURGH, PA.**

Canadian Representatives:
Williams & Wilson, Ltd., Montreal. A. R. Williams Machinery Co., Toronto and Winnipeg.

"TWINS" EXCITE ADMIRATION

Because They Earn It

Think of a TWIN when you hear the word STRAINER

The installation of a Twin Strainer on your water supply line eliminates troubles, worry, waste of time and expense—because

It has two straining baskets—that may be cleaned alternately, thus permitting continuous operation.

It has but two valves—they are of the gate type and are always tight.

It gives a direct flow with minimum friction loss, insuring easy operation with no waste of energy.

In fact, a Twin Strainer is an insurance policy in active service.

Designed to protect and built to last.

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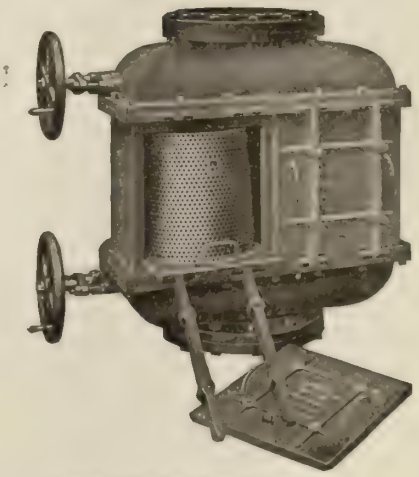

THE TWIN STRAINER.

ELLIOTT COMPANY

6902 Susquehanna Street, **PITTSBURGH, PA.**

Manufacturers of Filters and Grease Extractors, Separators, Blow-off Valves, Feed Water Heaters and General Power Accessories.

CANADIAN REPRESENTATIVES:
Willams & Wilson, Ltd., Montreal. A. R. Williams Machinery Co., Ltd., Toronto and Winipeg.

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operating valve. Tables are included giving the principal dimensions, capacities, code words, etc., for each type and size. This is a handsome catalog, the reading matter being in good type and illustrations clear. Copies will be gladly sent on request.

The Morris Machine Works, Baldwinsville, N.Y. have issued a handsome catalog describing the line of centrifugal pumps which they manufacture. An interesting feature of this catalog is the section devoted to the design and characteristics of centrifugal pumps which also includes several efficiency curves. Many illustrations are given, showing their pumps driven by various types of motive power, also several tables giving the principle dimensions, capacities, etc., for each type and size. The Storey Pump & Equipment Co., Toronto, are the Canadian agents for this firm and will be glad to send copies to interested readers.

"**The Lagonda Air Cleaner,**" is the title of Bulletin Y, recently issued by the Lagonda Mfg. Co., of Springfield, Ohio. It describes a new type of air driven boiler tube cleaner which has several novel features. One is the use of an adjustable air admission port in the corner, by means of which the size of the air opening can be adjusted to exactly meet the air pressure conditions in any given plant, thus insuring that the cleaner develops the maximum amount of power for the quantity of air consumed under all conditions. The method of dismantling the cleaner is extremely novel. It is only necessary to loosen a hexagonal retaining ring at the front which renders all of the interior parts of the cleaner readily accessible without the use of tools. Copies of this

"**The Lagonda Roller Bearing Cleaner**" is the title of Bulletin X, recently issued by the Lagonda Mfg. Co., of Springfield, Ohio. It describes a new type of water driven boiler tube cleaner which they have just perfected and put on the market. In this new cleaner, the old type thrust bearings have been replaced by tapered roller bearings. It is pointed out in the bulletin that experience and long service have proven that bearings of this type are admirably adapted for use on automobiles, where the bearings are subjected to severe thrusts, and as these are the conditions encountered in turbine tube cleaners the adoption of this bearing has resulted in a marked increase in efficiency and power output of the new type of cleaner. Copies of the bulletin may be had by addressing the company as above.

Personal

Jens Orten Boving in a letter to J. S. Flavelle, Lindsay, Ont., announces that plans are ready, and four men from the Swedish works of the Boving Co., will be sent to prepare for building the new plant at Lindsay.

K. L. Aitken, formerly general manager of the Toronto Hydro-electric System, has returned from Europe, and will resume his practice as consulting engineer. Letters may be addressed meantime, in care of the Toronto Hydro-electric System, 226 Yonge St., Toronto.

Sir Alexander Binnie, a member of many scientific institutions, who constructed the Blackwall Tunnell and the Nagpore Waterworks, and who was at one time chief engineer to the London County Council, and more recently was engaged to report on the water supply of Ottawa, Ont., has had the misfortune to lose a leg, which had to be amputated in consequence of arterial trouble.

H. W. Curling has been appointed managing director of the Canadian Union Electric Co., Toronto. Mr. Curling has been connected with The Union Electric Co. of London, Eng., since 1905, and spent three years in South Africa in their interest, during which time he engineered, among others, the following contracts:—The total installation of plant and transmission line at Roodepoort and Maraisburg; the electrical plant installation in workshops of South African railways, and the light, heat, and power plant for the Randt Daily Mail, Johannesburg's leading newspaper. The Canadian Union Electric Co. headquarters will be on Wellington Street W., Toronto, and branches will be opened in several important cities.

New Incorporations

Kerry & Chace, Ltd., incorporated at Toronto, capital $40,000, to carry on the business of engineers and contractors at Toronto. Incorporators: John G. G. Kerry, William G. Chace, etc., Toronto.

Ogden Electrical Mfg. Co., Ltd., incorporated at Ottawa, capital $100,000 to manufacture electrical appliances and instruments at Toronto. Incorporators: James F. Edger, James E. Maybee, etc., Toronto.

Upper St. Lawrence Power Co., Ltd., incorporated at Ottawa, capital $3,000,000, to purchase, lease and operate water powers, etc., with headquarters at Toronto. Incorporators: James S. Lovell, William Bain, etc., of Toronto.

North American Development & Construction Co., Ltd., incorporated at Ottawa, capital $100,000, to carry on the business of hydraulic and electrical engineers at Winnipeg. Incorporators, Standish R. G. Vereker, Hamsterley, William J. W. Bullock, Winnipeg.

Tenders

Regina, Sask.—Tenders will be received until Oct. 25 for the supply of one 3,000-kilowatt steam turbine with condenser and one hand power crane for 45-foot span. Specifications may be obtained from E. W. Bull, superintendent of the light and power department.

DRYDOCK CO. LOSES FRANCHISE AND BONUS.

OWING to the failure to send any representative to Sault Ste. Marie on October 1, the Sault Ste. Marie Dry Dock & Shipbuilding Co., which was represented by Dr. Cassoretty of Paris, who was endeavoring to raise the necessary finances for the commencement of the dry dock project, has now lost its franchise and a bonus of $5,000 per year for a period of twenty years, this being the amount embodied in an agreement with the city.

During the early part of the year, Dr. Cassoretty and B. H. Pethic of the British Engineering firm of Pethic Bros., secured an extension of time in which to commence operations. The time set was Oct. 14. Should they come forward now with any proposal it will be necessary to put a new by-law before the people. The supposition is that the principals have found it difficult to raise the funds and have abandoned the project.

Be a philospher; but, amidst all your philosophy, be still a man.

MONCRIEFF'S "UNIFIC" WATER GAUGE GLASSES
Stand in a Class by Themselves for Quality, Efficiency and Economy
A trial will convince you. Write for Catalog
W. J. WALL, 136-134 BLEURY ST., MONTREAL
(Canadian Representative)

Classified Advertisements.

Those who wish to sell or buy a business, obtain competent help, connect with satisfactory positions or secure aid in starting new enterprises, should not fail to use the Want Ad. Page of The Power House.

Do you want to sell or buy a second hand engine or any other equipment? Let The Power House pick out a seller or buyer for you.

There is always some one looking for just such proposition as you have to offer.

RATES (payable in advance):—2c. per word first insertion, 1c. per word subsequent insertion, 5c. additional each insertion when Box Number is required. Each figure counts as one word.

AGENTS WANTED

LIBERAL COMMISSIONS TO DEALERS AND others handling Vulcan Soot Cleaners; applied to all types of boilers. Vulcan Tube Cleaning Systems, Limited, 42 Craig St. West, Montreal. (tf)

WANTED — EVERY POWER HOUSE IN Canada to remember that C. E. Shedrick, Craig Street West, Montreal, is still repairing measuring instruments, both switchboard and portable. Twenty-five years' experience in repairing all kinds and makes on the market. Integrating meters repaired, tested and sealed, and returned on quick time. (tf)

FOR SALE

BELTING FOR SALE — 800,000 FEET OF best quality leather, rubber, hair and canvas belting, bought from bankrupt manufacturers at 25% to 75% less than the regular value. Also a large quantity of slightly used belting, piping, chains, rails, pulleys, hangers, cotton waste, etc., at very low prices. Send for catalogue. Imperial Belting & Supply Co., 5 Queen Street, Montreal. (tf)

FOR SALE—A 90 H.P. BRUCE MACBETH gas engine, complete with 75 K.V.A. dynamo, switchboard and exciter. All in first-class condition; in use less than four months; a bargain. The Winkley Company, Detroit, Mich. (10)

MISCELLANEOUS

PRACTICAL COURSES BY MAIL IN STATIONARY Engineering, Traction, Marine, Gasoline, Automobile, Locomotive, Electric Lighting and Power. Write, stating in what you are interested. Canadian Correspondence College, Limited, Dept. P.H., Toronto, Canada. (8)

DIXON'S
TRACTION
BELT DRESSING

Is a perfect belt preservative for any kind of belting, penetrating the fibres, giving perfect internal lubrication, protecting against water, steam and chemicals, and increasing the adhesive properties. The life of the belt and its power transmitting capacity are increased. Write for "The Proper Care of Belts," No. 222.

Made in JERSEY CITY
N. J., by the

JOSEPH DIXON CRUCIBLE CO.
Established 1827.

THE BAR-KEEPER'S FRIEND

Best known Metal Polish. Guaranteed forever. Largest sale in the World.

THE CANADIAN TURBINE WATER WHEEL — CONSERVE THE WATER POWERS — TRADE MARK.

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Meaford : Ontario

WATER POWER EQUIPMENT ONLY

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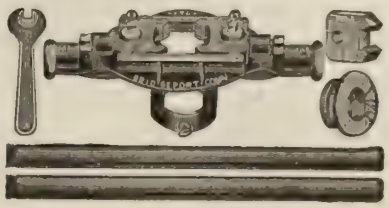

GENUINE ARMSTRONG STOCKS AND DIES FOR CUTTING PIPE & BOLTS ARE THE BEST.

PIPE MACHINES
PIPE CUTTERS
HINGED PIPE VISES
RATCHET ATTACHMENTS

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REDUCE YOUR BELTING EXPENSE

Reasons Why

BECAUSE! It lasts longer than any other belt on the market.
BECAUSE! It slips just one-half that of any other belting.
BECAUSE! It will run equally well in damp, wet or a dry atmosphere.
BECAUSE! It is less affected by acid fumes and high temperatures than any other belting.
BECAUSE! It is uniform in thickness and runs true.
BECAUSE! Of its great strength—almost twice that of best oak tanned double leather.
BECAUSE! It requires much less attention than other styles of belting.
BECAUSE! The stretch comes out quickly and after taking up once or twice (according to load and nature of run), requires little or no more attention.
BECAUSE! It transmits more power than any other belting.

BY USING

"CAMEL HAIR" CAMEL BRAND BELTING

Sole Makers

F. Reddaway & Co.
MONTREAL, QUE.

ALSO

Exclusive Agencies where full stocks of "Camel Hair" Belting are carried, viz:—

A. R. Williams Mchry. Co., Ltd., Toronto, Ont.

A. R. Williams Mchry. Co. of Winnipeg, Ltd., Winnipeg, Man.

A. R. Williams Mchry. Co. of Vancouver, Ltd., Vancouver, B. C.

Comparative Tests
vs. Best Double Leather Belting

4-in. Best Double Leather broke at	4,900
4-in. "Camel Hair" broke at	6,866
6-in. Best Double Leather broke at	5,641
6-in. "Camel Hair" broke at	11,575
8-in. Best Double Leather broke at	11,271
8-in. "Camel Hair" broke at	14,000
10-in. Best Double Leather broke at	15,000
10-in. "Camel Hair" broke at	21,000

HINTS TO BUYERS

Mueller Pressure Reducing and Regulating Valves

Give accurate and absolute control of pressures of water, steam, air, gas, oil, carbonic and acetylene gases—in fact, all kinds of pressures. Their efficiency is firmly established. Manufactured under Canadian patent No. 127,566. Address:

H. Mueller Mfg. Company, Ltd.
Sarnia - Ontario

LUBRICATING OILS

Canadian Oil Companies, Limited

TORONTO MONTREAL ST. JOHN
HALIFAX WINNIPEG
REGINA CALGARY
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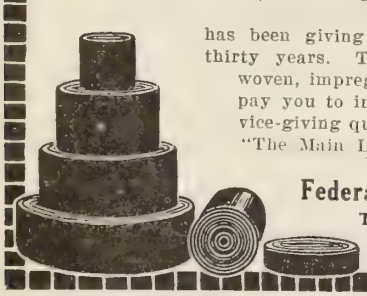
Scandinavia Belting



has been giving satisfaction to users for thirty years. This is the original solid woven, impregnated cotton belt. It will pay you to investigate its superior service-giving qualities. Write for booklet, "The Main Drive."

Federal Engineering Co., Ltd.
Toronto Montreal

Don't Use Boiler Compounds

Which are always injurious to boilers and valves.

We guarantee an absolute Metal Clean Boiler, when there is sufficient exhaust steam. Get the Nobis habit around your power plant.

Best References

The Nobis Engineering Co.

GUSTAV NOBIS
Rheydt, Germany
ENGINEER, MANUFACTURER AND HEATING CONTRACTOR
Founded 1880

Heating Engineers and Contractors
329 King St. West, Toronto
Phone Adelaide 3669.

Notice to Stationary Engineers

Everyone operating a Stationary Steam Plant of 50 h.p. or over, in the Province of Ontario, must hold a Certificate from this Board. Anyone operating such a plant without a Certificate is liable to the penalties set forth in the Stationary Engineers' Act

HON. J. S. DUFF,
Minister of Agriculture

W. C. McGHIE,
Chairman of Board,
Parliament Buildings, Toronto

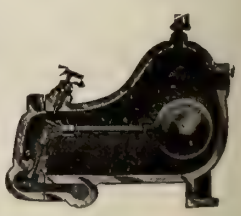
McDANIEL IMPROVED STEAM TRAP

FOR HIGH OR LOW PRESSURE.

Steam can't blow through. They have large discharge valves and cannot be flooded from sudden flushes of water.

MAY WE SEND ONE FOR TRIAL?

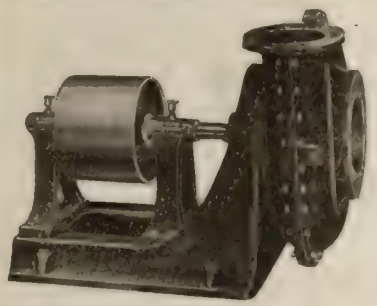
Reducing Valves, Pump Governors, Relief Valves, Exhaust Pipe Heads, Ejectors and Steam Separators. SEND FOR CATALOGUE.



THE GARTH COMPANY
26 Craig St. MONTREAL, CAN.
WATSON & McDANIEL CO.,
No. 146 N. 7th St. PHILADELPHIA, Pa.

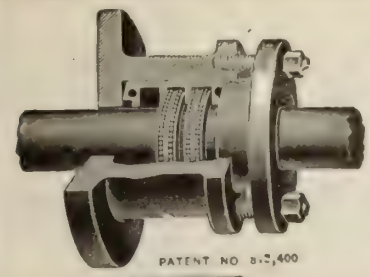
The advertiser would like to know where you saw his advertisement—tell him.

WE MANUFACTURE ALL KINDS OF STEAM AND POWER PUMPS FOR ALL KIND OF SERVICES.



Using only the best of material and workmanship.

The SMART-TURNER MACHINE CO., Limited
Hamilton Canada



PATENT NO 8[illegible]2,400

PAT. NO. 436,177 " " 500,899 " " 534,104 " " 602,328

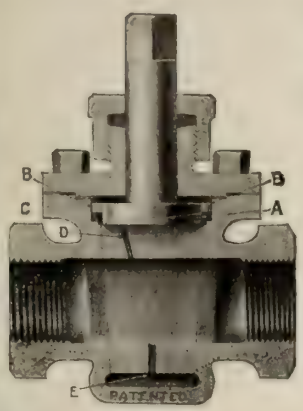
PAT. NO. 654,847 " " 654,842 " " 726,588

Why not Buy the Best, when in market for Packing?

HOLMES'
Metallic Packing
is Guaranteed 3 years

Lasts many times longer. 30 days trial. Less oil. No cutting. Easily applied to any Steam Engine, Air Compressor or Gas Engine. Satisfaction or no pay. Write us.

Holmes Metallic Packing Co., Wilkes-Barre, Pa.

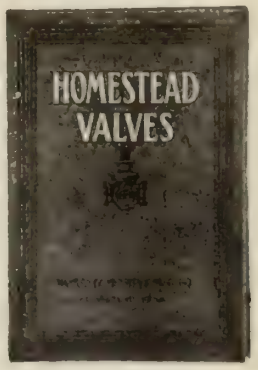


Mr. Buyer-For-The-Steam-Plant Find Out About "HOMESTEAD" Valves

They are the best possible investment for pneumatic and hydraulic machinery and boiler blow-off as well as for work in handling sulphur laden water, acid, caustic soda, etc.,—a Straightway Plug Valve with all former disadvantages of the type entirely eliminated.

Drop us a line for this new Catalogue "R."

Homestead Valve Manufacturing Co.
Pittsburgh, Pa., U. S. A.



Here's Your Copy of the Starrett Catalog No.20 C.D.

It is just off the press. Its 320 pages are brim full of information, illustrations, and prices on the most complete line of mechanics' fine tools manufactured. And it has lots of tables and data for machinists and engineers. We want every man who ever uses tools to have a copy of this catalog so that he can quickly tell what tool he needs.

Write to us now or get a copy at your hardware dealer's

The L. S. STARRETT CO.
THE WORLD'S GREATEST TOOL MAKERS
ATHOL, MASS. 42-224

Toronto Engineers Should Join The

Canadian Association Stationary Engineers

Toronto No. 1

Meets on the 2nd and 4th Wednesdays in Foresters' Hall, 22 College Street.

Any engineer who wishes to join will be welcomed.

On the 4th Wednesday, from October to April, the meetings are open to all, and lectures are to be given by competent men on all subjects pertaining to engineering.

EMPLOYERS

who wish to secure competent men are invited to write the Secretary, who will be pleased, at all times, to get them good men.

JOHN W. MARR, Secretary
78 Duke Street

JOHN C. TWEEDALE, Pres. C. MOSLEY, Treas.

The advertiser would like to know where you saw his advertisement—tell him.

COAL

The freight and duty is the same on **high grade coal** as on medium or low grade coal.

Our **Lone Star** small coal is **guaranteed** to show 14,000 B.T.U.'s regularly.

Our specialty in Canada is high grade coal from Kentucky and West Virginia via Detroit.

Let us have your inquiries, and call on us if in need of **prompt shipment,** via Buffalo, Car Ferry or Detroit.

Ohio & Michigan Coal Co.

Mines in Ohio, West Virginia and Kentucky

Main Office
82-83-84 Home Bank Bldg., DETROIT, MICH.

THE
CANADIAN CASUALTY AND BOILER INSURANCE COMPANY

This Company makes a specialty of inspecting boilers under construction, and issues an official Certificate of Inspection, as required by the Laws of Ontario which came into force on the 1st July.

CONTINENTAL LIFE BUILDING
TORONTO

J. O. B. Latour, Chief Engineer. John J. Durance, Manager.

Phone Main 6941

Schneider & Helmecke, Magdeburg Germany

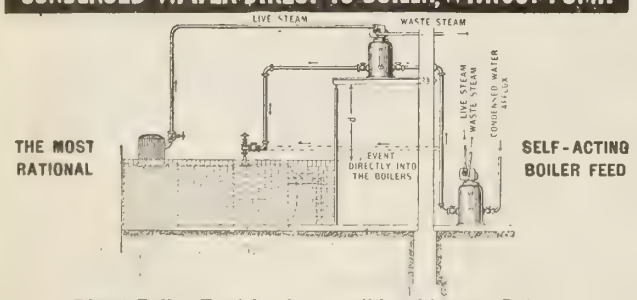
RETURN STEAM TRAP FOR FEEDING BACK HOT

Founded B. In 1678 HSI Export

GREAT SAVING IN COALS AND WORKING EXPENSES.
INCREASED BOILER EFFICIENCY.
INCREASED LIFE OF BOILER.
MINIMUM OF BOILER INCRUSTATION.

SCHNEIDER & HELMECKE-MAGDEBURG Special Works for Steam Traps.

CONDENSED WATER DIRECT TO BOILER WITHOUT PUMP.



Direct Boiler Feed is also possible with **one** Return Steam Trap according to the situation.

Dominion Sugar Company, Ltd. We received your favour of the 5th inst. and noted its contents. To our great satisfaction we are able to inform you that your **Return Steam Traps,** are working excellently. We have now installed all **four,** which have worked faultlessly right away from the commencement. — One double Return Steam Trap suffices for conveying the condensed water from 6 Sperber drying apparatus directly back to the boilers. — *Since the Return Steam Traps were installed the feed pump for the boilers of the splitting-drying department has not been used.* — **The saving in coals is considerable,** since by aid of the Return Steam Traps we can now easily keep up full steam, **whereas previously we had constantly to force the boilers to the utmost.** After the experience gained with your condensed water Return Steam Traps we must admit, that no plant ought to be without the same. **The feed pump has always been a unisance to us.**
We leave it to your discretion to make whatever use of this you please.
Wallaceburg (Canada), Ont., Novbr. 22 nd, 1909.

Machine Banded Wood Stave

WATERPIPES and TANKS

For city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited

P.O. Box 563 **Vancouver, B.C**

WRITE FOR CATALOGUE

Full Particulars and Estimates Furnished

The advertiser would like to know where you saw his advertisement—tell him.

Second Hand
BOILERS

We have a few exceptionally good Second-Hand Horizontal Tubular Boilers in stock which we are offering at very attractive prices.

Some of them are practically new and all of them are in good order, and if you want a second-hand boiler, this is a particularly good opportunity for you.

Shall we send you particulars?

William Hamilton Co.
PETERBOROUGH, ONT.

It Means a Saving of Money and Trouble

Electric Boiler Compound is an effective remedy for all boiler troubles due to impurities in the feed water.

It quickly removes scale without causing the slightest injury to the tubes or fittings, and saves fuel by increasing faster efficiency.

Try a Barrel

Send us a sample of your feed for analysis and get our prices.

Our line of high-grade **Lubricating Oils, Greases, Packings and Engine Supplies** meet the complete approval of all engineers who have tried them. **It will be to your interest to get samples.**

The Electric Boiler Compound
COMPANY, LIMITED
Guelph, Ontario

Get the Genuine

Over 1,250,000 Detroit Lubricators are in use to-day —giving daily satisfaction on every kind of machine. The reputation earned by these lubricators—some of which have been in service over a third of a century—has resulted in a host of imitations.

These imitations are not as good as the genuine Detroits. If they were, they would be sold on their own merits, and not on the basis of being as good as the "Detroit."

The appearance of Detroit Lubricators may be closely copied, but the experience of thirty-six years in the study of lubricators and lubrication, which lies behind every Detroit Lubricator — the long experience in designing and building — the magnificent manufacturing facilities of the largest makers of lubricators in the world — these things cannot be copied.

Genuine Detroit Lubricators embody in a perfectly balanced design all the essentials and refinements of a modern lubricator.

There is one particularly suited for any engine you may have.

CANADIAN DETROIT LUBRICATOR COMPANY, LTD.
WALKERVILLE, ONTARIO
Largest manufacturers of lubricating devices in the world.

Save Fuel and Increase Profit

A few engineers find this a difficult problem. They are not acquainted with

The "OTIS"
TUBULAR FEED WATER HEATER, OIL SEPARATOR AND PURIFIER

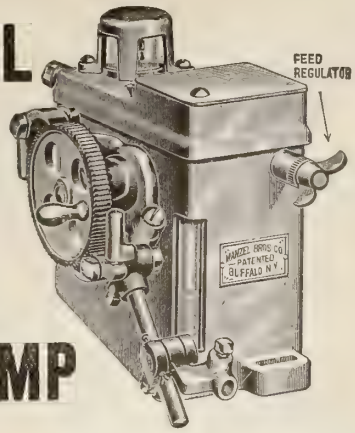
The exhaust steam when harnessed and passed through this Heater will heat the Feed Water to a boiling point before it enters the boiler. This effects an enormous yearly saving in fuel.

Write for descriptive catalog and prices.

The STEWART HEATER CO.
189 Norfolk Ave., Buffalo, N.Y., U.S.A.

MANZEL

Automatic Force and Sight Feed OIL PUMP



Sent on Thirty Days' Free Trial to Prove that it Saves 50% of Oil

A 50% saving in oil guaranteed wherever the "Manzel" is used.

With this Pump Oil is fed into the cylinder regularly, and positively all the time—no matter how slow the engine runs, what pressure the steam is carried, how high or low the temperature.

Simply return the "Manzel" at our expense if not exactly as represented.

Write to-day.

The Twin City Oil Company General Agents for Canada
BERLIN, ONT.
Manzel Brothers Company, Buffalo, N.Y.

Eugene F. Phillips Electrical Works, Limited
MONTREAL CANADA

Bare and Insulated Electric Wire

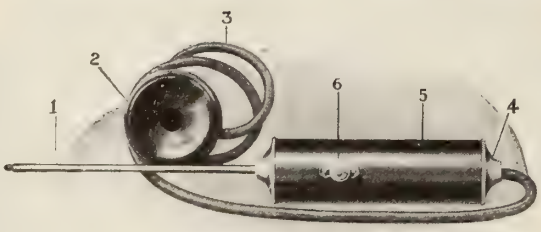
Electric Light Line Wire. Incandescent or Flexible Cords.

Railway Feeder and Trolley Wire

Americanite, Magnite, Office and Annunciator Wire. Cables for Aerial and Underground Use.

HALIFAX TORONTO WINNIPEG VANCOUVER

FOR WATERWORKS



is this little instrument of

Inestimable Value

By means of the **DETECTORPHONE** the exact location of the leak may be ascertained in a very few minutes.

Write for circular and prices.

THE MAIHAK INDICATOR AGENCY

3 Beaver Hall Square .:. .:. .:. MONTREAL

BEATH CRANES CHAIN BLOCKS TROLLEYS OVERHEAD RUNWAYS

Solve Coal, Machinery and Merchandise Handling Problems.
Hand, Pneumatic and Electrically Operated
Tell us what you wish to do, and we'll suggest the proper equipment for you.

W. D. BEATH & SON, Limited
Engineers and Manufacturers
20-30 Cooper Ave, TORONTO
The A. M. Ellicott Co, 301 James St , Montreal Que.
Sole selling agents for the Province of Quebec

The advertiser would like to know where you saw his advertisement—tell him.

WHY USE OIL

When GREASE Gives More Uniform Lubrication, Is Better and Much Cheaper?

This Grease Cup will pay for itself many times over with the money it saves in lubricants.

You know that Oil cannot be properly controlled—much of it is lost through dripping.

Grease when used in this Grease Cup is under perfect control until the last drop is used.

The efficiency of this Grease Cup cannot be affected by centrifugal force when used on loose pulleys.

REMEMBER we guarantee it to save 50% over any other system.

Give it a trial and be convinced.

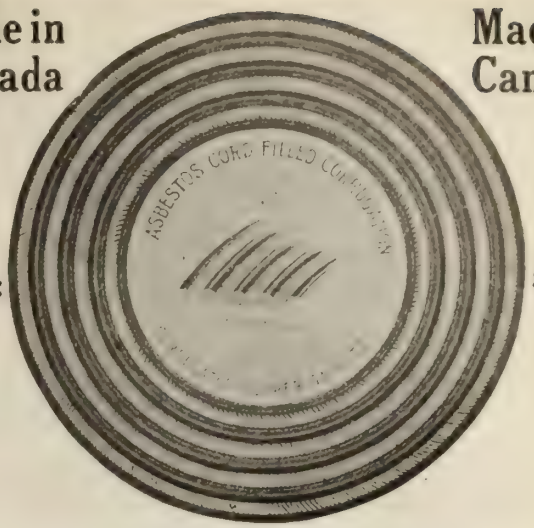
Write for particulars.

Peterborough Machine and Lubricator Co., Limited

Peterborough, Ontario

Made in Canada

Made in Canada



Cheapest Gasket in Canada

Net prices for above Gaskets are as follows:—

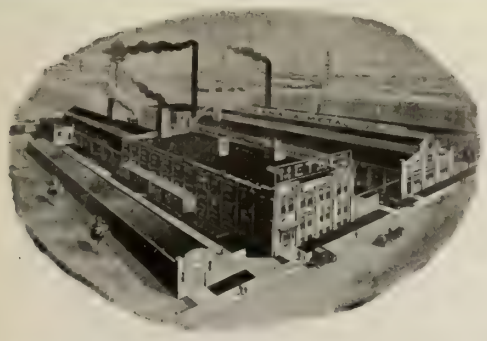
2 in. Std	17c. Ex Hy 20c.	6 in. Std	50c. Ex Hy 56c.
2½ in. Std	21c. Ex Hy 24c.	7 in. Std	58c. Ex Hy 65c
3 in. Std	25c. Ex Hy 28c.	8 in. Std	67c. Ex Hy 74c.
4 in. Std	34c. Ex Hy 37c.	10 in. Std	85c. Ex Hy 93c.
5 in. Std	43c. Ex Hy 47c.	12 in. Std	99c. Ex Hy $1.10

Absolutely the best and cheapest Gaskets on the Market to-day.

WRITE FOR SAMPLES

Canadian Gasket Co., Bridgeburg, Ont.

Manufacturers of all kinds of Metal Gaskets



SEND ME A BOX OF BABBITT
THE KIND THAT DOES NOT WEAR OUT

WE RECEIVED A LETTER from a customer a few days ago, the following is an extract, "Send me a box of Babbitt, same as last, I forget the name, but it is the kind that does not wear out."

This is a Testimonial Indeed and one Straight from the Heart.

The writer of the letter above mentioned had evidently got a Babbitt Metal just suited to his specific purpose.

THAT IS WHERE WE EXCEL. We can advise you, it costs you nothing to take advantage of our years of practical experience. If you have Babbitt Troubles, why not ask our advice?

WE RECOMMEND

IMPERIAL GENUINE "The Highest Grade of Babbitt Metal manufactured" for all High Speed Engines and Bearings carrying extremely heavy loads.

HARRIS HEAVY PRESSURE "The Babbitt Metal Without a Fault" for all General Machinery Bearings.

ALUMINOID For Medium and Light Running Machinery.

EVERY USER OF BABBITT METALS SHOULD GET OUR PRICES.

THE CANADA METAL CO., Limited

Head Office and Factory: TORONTO. Branch Factories: MONTREAL, WINNIPEG

The advertiser would like to know where you saw his advertisement—tell him.

Wasted Condensation is Wasted Money!

It is very important that condensation should be handled in the most efficient way in your steam plant.
The old pump method is inefficient and wasteful.
Let us send you a

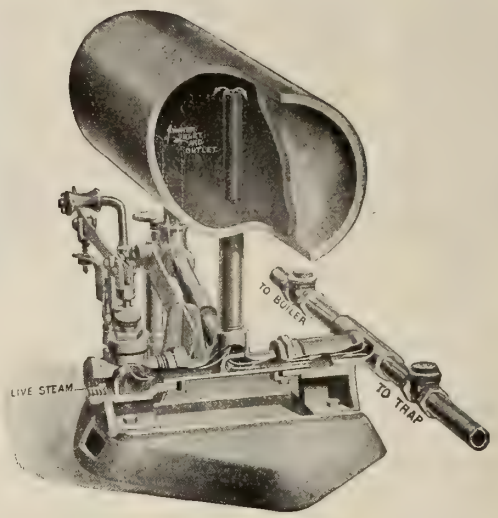
Morehead
Back to Boiler
SYSTEM

on our absolute guarantee basis to test in your own plant at your own convenience.

Simply send us your conditions, heating, drying, cooking, etc., and we will send a trap to suit conditions.

We make several different combinations—Vacuum, Condenser, Return and Non-Return Traps. Say which type.

By comparing results with those of your pump you will find that the **Morehead System cuts your fuel bills in two; saves excessive repair bills and gives a much more efficient heating system.**



Every ounce of the Condensation in **Steam** Lines goes back to the Boiler with practically no drop in temperature.

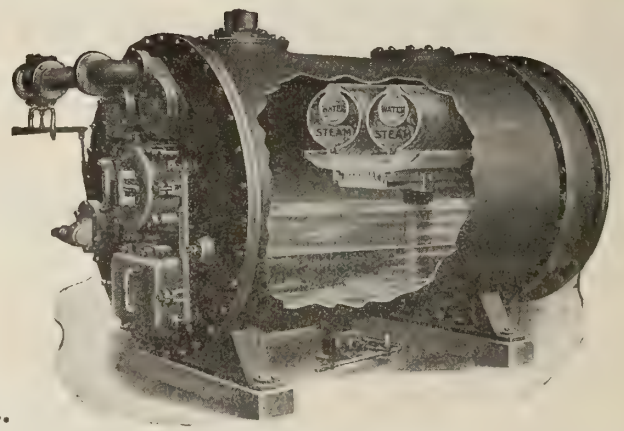
Morehead Traps have proven their superiority by actual service.

You simply cannot afford to be without our up-to-the-minute system.

Ask for booklet.

Canadian Morehead Mfg. Co., Ltd. WOODSTOCK ONTARIO

We Advise Without Prejudice



for we make both open and closed heaters.

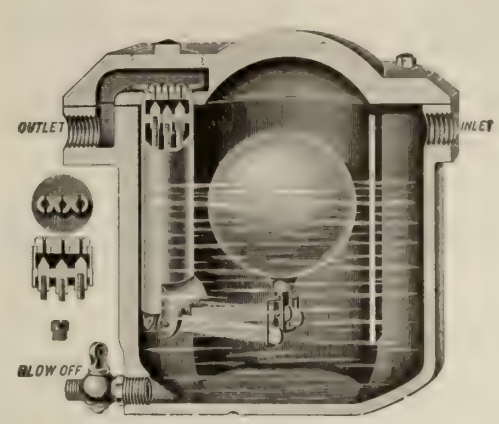
Ask us for an answer to your feed water problem—
we'll give it to you straight, for one form or the other of

NATIONAL
FEED WATER HEATER

will do the trick. Ask for Catalog No. 2

The National Pipe Bending Company
91 Lloyd Street, New Haven, Conn.
Makers of Pipe Coils and Bends of every Description—for all Purposes—Iron, Brass, Copper 46-47

The advertiser would like to know where you saw his advertisement—tell him.



Wright
"Emergency" High Pressure Continual Flow Steam Trap

THREE VALVES

GREAT CAPACITY

Keeps the steam line automatically and continually drained of accumulating condensation.

Shipped subject to trial and return if results are not satisfactory.

Send for Catalog.

DARLING BROS., Limited

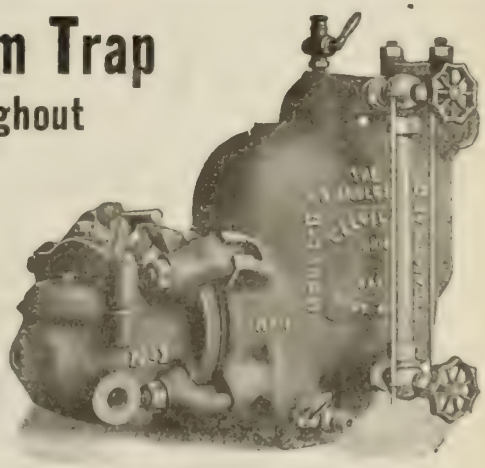
15 Ottawa Street, MONTREAL

TORONTO WINNIPEG ST. JOHN, N.B.

The Anderson Model "D" Steam Trap
Will Maintain An Even Temperature Throughout Your Heating System

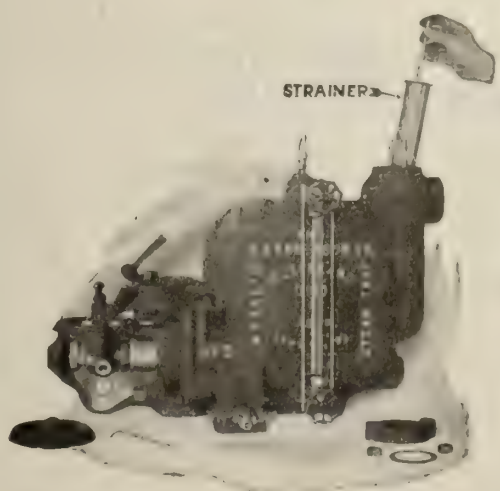
This is a Continuous, Reliable and Steady Drainer which disposes of the Condensation as fast as it accumulates without reducing the pressure or permitting live steam to escape.

This Steam Trap is a wonderful remedy for faulty heating systems.



All parts are interchangeable. The working mechanism is very simple, and has no weak part.

The trap is so constructed that you can change the valve and seat from high or low pressure or vice versa in five minutes without disturbing or unscrewing a single joint or pipe connection.



Sectional View
REMOVING THE STRAINER

A Removable Perforated Strainer (as illustrated) is part of the equipment. It prevents pieces of scale, packing lead, etc., from entering the trap.

Every Model "D" is tested and guaranteed.

Our descriptive booklet will give you full particulars—let us send it now.

The V. D. Anderson Co.
West 96th Street, Cleveland, Ohio

BRANCH OFFICES: 330 Manhattan Building, Chicago, Ill.; 619 Park Bldg., Pittsburg, Pa.; 3 Arch St., Philadelphia, Pa.; 212 Walnut St., Cincinnati, Ohio; 207 Union Trust Bldg., Baltimore, Md.; 91 High Street, Boston, Mass.

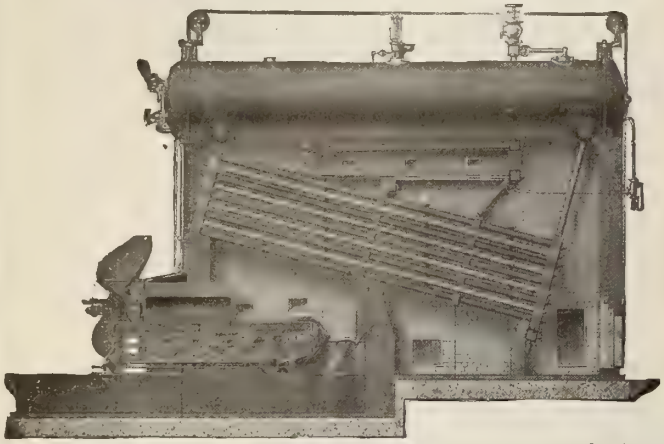
The advertiser would like to know where you saw his advertisement—tell him.

BABCOCK & WILCOX, Limited

"B.&W." PATENT WATER TUBE STEAM BOILERS

With Furnaces for all Classes of Fuel or Waste Gases

HIGHEST ECONOMY, SAFETY, DURABILITY. OVER 10,000,000 H.P. IN USE



Babcock & Wilcox Patent Water Tube Steam Boiler, Superheater and Mechanical Stoker.

ALSO

Steam Superheaters
Mechanical Stokers
Coal-Handling Machinery
Piping, Feed Water Heaters
Water Softeners and Purifiers
and **ELECTRIC CRANES**

Our Book "STEAM" sent on request

HEAD OFFICE FOR CANADA - COLLEGE ST. (ST. HENRY), MONTREAL
TORONTO OFFICE, TRADERS BANK BUILDING

Present Day Experience in Power Plant Operation Recognizes the Necessity of

Treating Boiler Feed Waters Scientifically

Feed Waters and power plant conditions differ, and water treatment, to be successful, must be made on scientific principles—to meet actual conditions.

DEARBORN TREATMENT

bears the relation to ordinary "boiler compounds" that eminent scientific diagnosis and prescription do to quack nostrums and "cure-alls."

Our thorough, scientific handling of the subject assures you of best possible service.

Dearborn Chemical Company of Canada, Limited
TORONTO, CANADA

Office, 705 C.P.R. Building. **Factory, 1220-30 Dundas Street.**

The advertiser would like to know where you saw his advertisement—tell him.

THE POWER HOUSE BUYERS' DIRECTORY

To our Readers:—Use this directory when seeking to buy power equipment or supplies. You will often get information that will save you money.

To our Advertisers:—Send in your name for insertion under the heading of the lines you make or sell.

To Non-Advertisers:—A nominal rate of $1 per line a year is charged non-advertisers.

Air Brakes.
Can. Allis-Chalmers, Ltd., Toronto.
Can. Westinghouse Co., Hamilton.

Air Compressors and Receivers.
American Steam Pump Co., Battle Creek, Mich.
Boving & Co. of Canada, Limited, Toronto.
W. H. Allen Son & Co., Bedford, Eng.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Can. Allis-Chalmers, Ltd., Toronto.
Can. Westinghouse Co., Hamilton.
Escher, Wyss & Co., Montreal.
Laurie & Lamb, Montreal.
Smart-Turner Machine Co., Ltd., Hamilton.
Arctic Ice Machine Co., Canton, Ohio.

Air Vents, Automatic.
Canadian Steam Boiler Equipment Co., Toronto.

Ammeters.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Can. Gen. Elec. Co., Ltd., Toronto.
Can. Westinghouse Co., Hamilton.

Ammonia Valves and Fittings.
Arctic Ice Machine Co., Canton, Ohio.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
York Mfg. Co., York, Pa.
Frick Co., Waynesboro, Franklin Co., Pa.

Ammonia Purifiers.
Frick Co., Waynesboro, Franklin Co., Pa.

Arches, Combustion Chamber.
Canadian Fairbanks-Morse Co., Ltd., Montreal.

Ash Carrying Systems
Orenstein-Arthur Koppel Co., Pittsburg.

Asbestos Specialties.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.
Garlock Packing Co., Hamilton, Ont.

Automatic Ice Recording Doors and Chutes.
Jones Cold Store Door Co., Hagerstown, Md.

Automatic Safety Feed Water Device.
Nobis Engineering Co., Toronto.

Babbitt and Anti-friction Metal.
Canada Metal Co., Toronto.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Hoyt Metal Co., Toronto.
Magnolia Metal Co., New York, N.Y.

Bearings.
Can. Bond Hanger & Coupling Co., Alexandria, Ont.

Belt Cement.
Graton & Knight Mfg. Co., Worcester, Mass.

Belt Dressing.
British Pac. Sup. Co., Victoria, B.C.
Cling Surface Co., Buffalo.
Jos. Dixon Crucible Co., Jersey City.
C. C. Snowdon, Calgary.
Stephenson Mfg. Co., Albany, N.Y.
Graton & Knight Mfg. Co., Worcester, Mass.

Belt Tighteners.
Waterous Engine Wks. Co., Brantford

Belt Pulleys.
American Pulley Co., Philadelphia.

Belting, Camel Hair.
F. Reddaway & Co., Montreal.

Belting, Stitched Cotton Duck.
F. H. Andrews & Son, Quebec.
Dominion Belting Co., Hamilton, Ont

Belting, Leather.
F. H. Andrews & Son, Quebec.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Garlock Packing Co., Hamilton, Ont.
D. K. McLaren, Ltd., Montreal.
Graton & Knight Mfg. Co., Worcester, Mass.

Belting, Rubber.
F. H. Andrews & Son, Quebec.
Jeffrey Manufacturing Co., Columbus.
Quaker City Rub. Co., Philadelphia.

Beltings, all kinds.
Reddaway & Co., F., Montreal.

Belting, Scandinavia.
Federal Engineering Co., Toronto.

Bending, Pipe.
National Pipe Bending Co., New Haven, Conn.

Bins, Coal, Coke and Ore.
Jeffrey Manufacturing Co., Columbus.

Blowers.
W. H. Allen Son & Co., Bedford, Eng.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Escher, Wyss & Co., Montreal.
Hare Eng. Co., Toronto.

Boiler Compounds.
Can. Oil Companies, Ltd., Toronto.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.
Perolin Co. of Canada, Toronto.
Dearborn Chemical Co., Chicago.
Electric Boiler Compound Co., Guelph, Ont.
C. C. Snowdon, Calgary.

Boiler Compound Feeders
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Hare Eng. Co., Toronto.
Lunkenheimer Co., Cincinnati, O.
Can. Morehead Mfg. Co., Woodstock, Ont.

Boiler Feed Pumps.
W. H. Allen Son & Co., Bedford, Eng.
American Steam Pump Co., Battle Creek, Mich.
Bawden Machine Co., Toronto.
Boving & Co. of Canada, Limited, Toronto.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Can. Allis-Chalmers, Ltd., Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
Hare Eng. Co., Toronto.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Nobis Engineering Co., Toronto.
Smart-Turner Machine Co., Ltd., Hamilton.

Boiler Feed Regulators.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Hare Eng. Co., Toronto.

Boiler Mountings.
Babcock & Wilcox, Montreal.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Darling Bros., Montreal.
Lunkenheimer Co., Cincinnati, O.

Boiler Tube Cleaners.
Garlock Packing Co., Hamilton, Ont.
Liberty Mfg. Co., Pittsburg.
Vulcan Tube Cleaning Systems, Ltd., Montreal.

Boilers, Horizontal, Return, Tubular and Watertube.
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Goldie & McCulloch Co., Galt.
Can. Allis-Chalmers, Ltd., Toronto.
Boving & Co. of Canada, Limited, Toronto.
Engineering Works of Canada, Ltd., Montreal.
Frick Co., Waynesboro, Franklin Co., Pa.
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Jenckes Machine Co., Sherbrooke, Que
Jones Underfeed Stoker Co., Toronto.
E. Leonard & Sons, London, Ont.
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Polson Iron Works, Toronto.
International Engineering Works, Ltd., Amherst, N. S.
Waterous Engine Wks. Co., Brantford

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Goldie & McCulloch Co., Galt.
Can. Allis-Chalmers, Ltd., Toronto.
Jenckes Machine Co., Sherbrooke, Que
E. Leonard & Sons, London, Ont.
John McDougall Caledonian Iron Wks, Montreal.
Polson Iron Works, Toronto.
International Engineering Works, Ltd., Amherst, N. S.
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Brine Tanks.
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American Pulley Co., Philadelphia.

Carbon Brushes.
Rougier Freres, Montreal.
Lunkenheimer Co., Cincinnati, O.

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Lunkenheimer Co., Cincinnati, O.

Cast Plate Track
Orenstein-Arthur Koppel Co., Pittsburg.

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Lunkenheimer Co., Cincinnati, O.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.

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Canadian H. W. Johns-Manville Co., Ltd., Toronto.

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Dearborn Chemical Co., Chicago.
C. C. Snowdon, Calgary.

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Engineering Works of Canada, Ltd., Montreal.
Can. Gen. Elec. Co., Ltd., Toronto.
Can. Westinghouse Co., Hamilton.
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Ohio & Michigan Coal Co., Detroit, Mich.

Clutches.
Elmira Machinery and Transmission Co., Elmira.
Waterous Engine Wks. Co., Brantford

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Babcock & Wilcox, Montreal.
Ed. Bemis & Co., Little Hulton, Bolton, Eng.
Hare Eng. Co., Toronto.
Jeffrey Mfg. Co., Columbus, O.
Geo. H. Tod, Toronto.

Coal Handling Machinery.
Ed. Bemis & Co., Little Hulton, Bolton, Eng.
Hare Eng. Co., Toronto.
Geo. H. Tod, Toronto.
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Coils.
Frick Co., Waynesboro, Franklin Co., Pa.

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Elmira Machinery and Transmission Co., Elmira.
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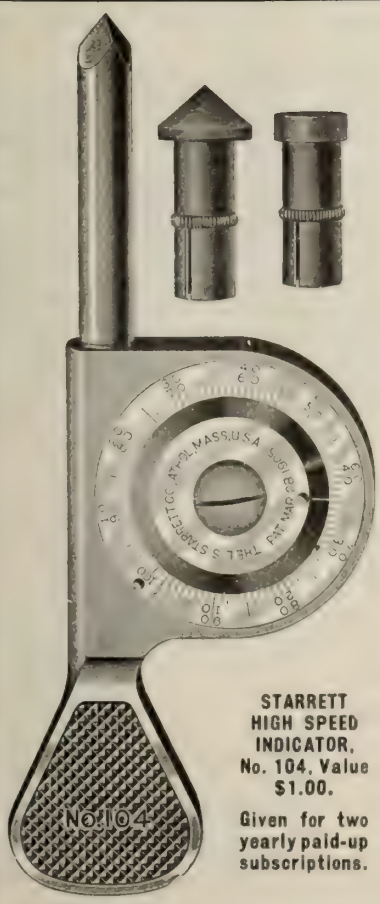

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York Mfg. Co., York, Pa.

Piping, Steam.
Babcock & Wilcox, Montreal.
Imperial Waste & Metal Co., Montreal.

Plate Work.
Can. Allis-Chalmers, Ltd., Toronto.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

Polish, Metal.
G. W. Hoffman, Indianapolis.

Power Pumps.
American Steam Pump Co., Battle Creek, Mich.
W. H. Allen Son & Co., Bedford, Eng.
Bawden Machine Co., Ltd., Toronto.
Boving & Co., of Canada, Limited, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Can. Allis-Chalmers, Ltd., Toronto.
Darling Bros., Montreal.
Goldie & McCulloch Co., Galt.
Goulds Pump Co., Montreal.
E. Leonard & Sons, London, Ont.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
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Waterous Engine Works Co., Brantford.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.
Garlock Packing Co., Hamilton, Can.

Power Transmission Machinery.
American Pulley Co., Philadelphia.
Can. Bond Hanger & Coupling Co., Alexandria, Ont.
Can. Fairbanks-Morse Co., Montreal.
Elmira Machinery & Transmission Co., Elmira, Ont.
Engineering Works of Canada, Ltd., Montreal.
Goldie & McCulloch Co., Galt.
Jeffrey Manufacturing Co., Columbus.
Jenckes Machine Co., Sherbrooke, Que.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Waterous Engine Works Co., Brantford.
Siemens Co. of Canada, Ltd. Montreal.

Pulleys.
American Pulley Co., Philadelphia.
Can. Fairbanks-Morse Co., Montreal.
Elmira Machinery and Transmission Co., Elmira, Ont.
Jeffrey Manufacturing Co., Columbus.
Waterous Engine Works Co., Brantford.

Pulp Mill Machinery.
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The Bawden Machine Co., Toronto.
Escher, Wyss & Co., Toronto.
Jeffrey Manufacturing Co., Columbus.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford.

Pumping Machinery.
American Steam Pump Co., Battle Creek, Mich.
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Bawden Machine Co., Ltd., Toronto.
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Smart - Turner Machine Co., Ltd., Hamilton.
Waterous Engine Works Co., Brantford.

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Bawden Machine Co., Ltd., Toronto.
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Canadian Steam Boiler Equipment Co., Toronto.
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Elliott Co., Pittsburgh, Pa.
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Canadian Steam Boiler Equipment Co., Toronto.
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Can. Fairbanks-Morse Co., Montreal.
E. Leonard & Sons, London, Ont.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.

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Can. Allis-Chalmers, Ltd., Toronto.
Engineering Works of Canada, Ltd., Montreal.
Canadian Boving Co., Toronto.
Escher, Wyss & Co., Toronto.
Hare Eng. Co., Toronto.
E. Leonard & Sons, London, Ont.
John McDougall Caledonian Iron Wks. Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.
Waterous Engine Works Co., Brantford.

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Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co. Hamilton.
Siemens Co. of Canada, Ltd. Montreal.

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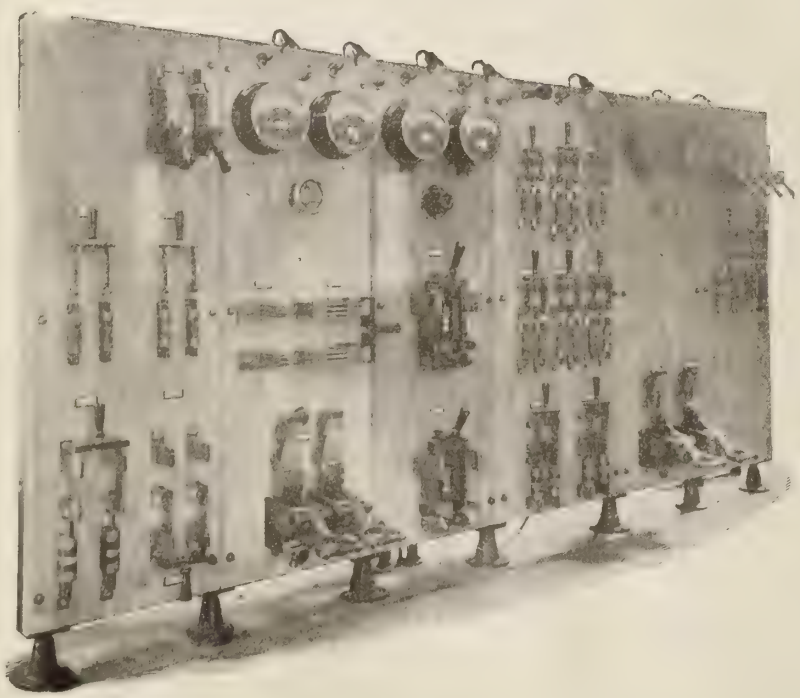

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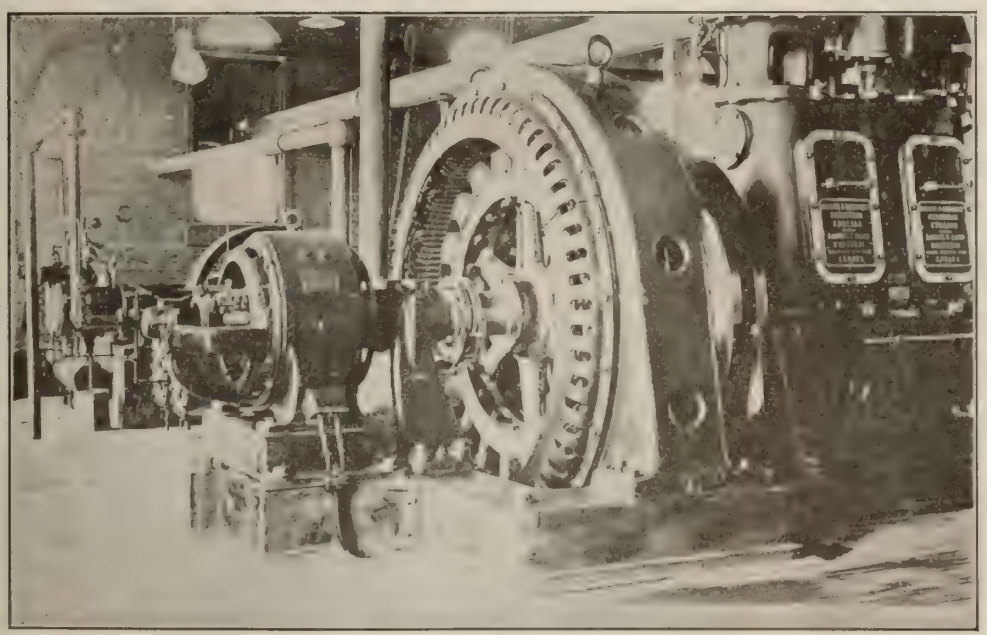

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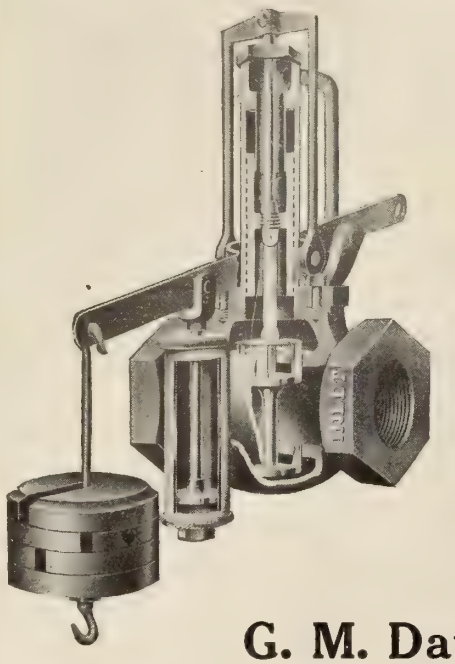

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Westinghouse Steam Turbines

In any plant where they are installed you will find Westinghouse Steam Turbines carrying the 24-hour load.

Canadian Westinghouse Co., Limited, Hamilton, Ont.

TORONTO	MONTREAL	OTTAWA	HALIFAX	WINNIPEG	CALGARY	VANCOUVER
Traders Bank Bldg.	52 Victoria Square	Ahearn & Soper, Ltd.	Telephone Bldg.	158 Portage Ave. E.	311 8th Ave. West	Bank of Ottawa Bldg

ESCHER-WYSS & CO.

ENGINEERS

52,000 H.P. Plant Western Canada Power Co.

HYDRAULIC
STEAM | **PLANTS**
PUMPING

HEAD OFFICE FOR CANADA:

626 Coristine Bldg.,

MONTREAL, Que.

Boiler Room Accessories of Proven Merit

Safety Valve—Lever and Weight Type.

"Gem" Ejector.

Pop Safety Valve.

Check Valve with Drip Cock.

Our lines give a service that spells both efficiency and economy in the boiler room.

They are up-to-date in design, and of the highest quality throughout — and they're approved of by the Boards of Steam Boiler Inspectors.

Ask us about any line or lines in which interested.

Prices are reasonable.

Quick Opening Radiator Valve.

Gauge Cock, Brass Wheel Handle

Oil Cup Quick Stop Sight Feed.

Hancock Inspirator.

Relief Valve.

The James Morrison Brass Mfg. Co., Ltd.

93-97 Adelaide Street West, TORONTO

Special Feature---Articles on Feed Water

THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas Electric, Air and Water Power; and to the operation of Refrigerating Machinery.
Published by The MacLean Publishing Co., Limited.

MONTREAL: Eastern Townships Bank Bldg. TORONTO: 143-149 University Ave. LONDON, ENG.: 88 Fleet St. E.C. WINNIPEG: 34 Royal Bank Bldg.

Vol. VI. Publication Office, Toronto—November, 1913 No. 11

TRADE PENBERTHY MARK

Regrinding Brass Valves

"THE ALL QUALITY LINE"

GUARANTEED FOR 200 LBS. PRESSURE

The Finest Valve on the Market

Some Sound Practical Reasons Why the Penberthy Valve is Superior

The bonnet is secured to body by heavy union ring, and the threads on bonnet end of body being on outside makes the above connection rigid, steam tight and non-corrosive, and permits free accessibility to valve at any time without strain or injury to same.

The regrinding feature of the Penberthy Valve with metal to metal seats, is much superior to, and more economical than, the composition disc valve, which type is only recommended for ordinary steam pressure and which necessitates the frequent renewing of discs at extra expense.

The regrinding feature of the Penberthy Valve entirely eliminates the necessity of renewing discs and permits both the seat of body and seat of disc to be reground together quickly and with no extra expense.

The metal is of the best quality and is so distributed that the parts subjected to the greatest strain and wear have proportionately heavier walls.

The design, workmanship and finish is not equalled by any other valve on the market.

"Specify Penberthy Regrinding Valves"

They will add to and increase the efficiency, economy and prosperity of every building or power plant in which they are installed.

Approved by and Registered in Ontario and the Western Provinces for Steam Pressures as high as 200 lbs.

MFG. BY

Penberthy Injector Co., Limited

WINDSOR, ONT.

PUMPING EFFICIENCY

HONEST HYDRAULIC PACKING

MANUFACTURED EXCLUSIVELY BY

PEERLESS RUBBER MANUFACTURING COMPANY

16 WARREN ST., NEW YORK.

FOR SALE EVERYWHERE

McEWEN ENGINES

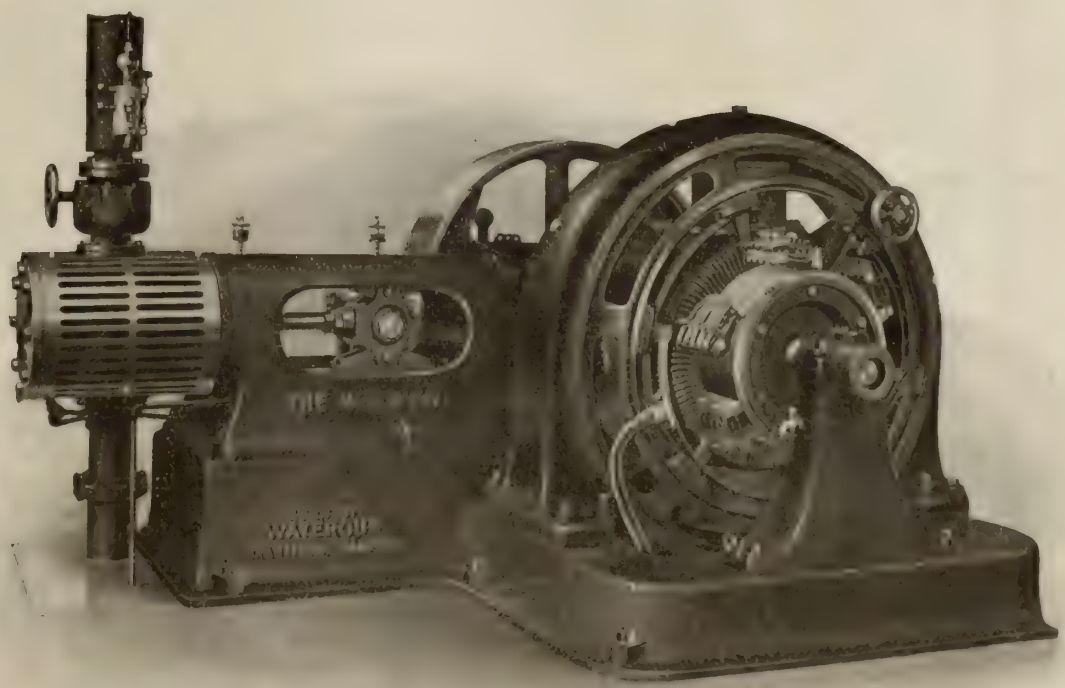
FOR ISOLATED PLANT USE

A McEwen in your Engine Room means economical power—and lots of it—all the time. Every dollar you put into your McEwen Engine you take out in continuous satisfactory, seven-day-in-the-week service.

Smooth, powerful, easy-running McEwen Engines improve with use. They are sold on a reputation for economy and efficiency, and are built and designed to *maintain* it year after year.

Hundreds of users in Canada will testify to this.

Our McEwen booklet is compact, well illustrated and interesting. It tells you what you want to know about McEwen Engines. Write for it.



THE WATEROUS ENGINE WORKS CO., LTD.

BRANTFORD, CANADA

The advertiser would like to know where you saw his advertisement—tell him.

The Dunham Air Line Valve

¶ Passes all air.

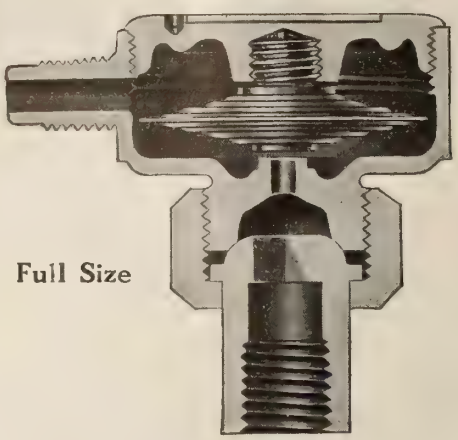
¶ Closes against steam.

¶ Has large valve opening, allowing quick discharge of air from radiator.

¶ Will not clog up.

¶ Is constructed of highest quality material and workmanship.

¶ Is guaranteed, for five years and any valves proving defective within that time will be replaced with new ones free.



Full Size

Trial Offer

If you are having trouble with the valves on your radiators and are continually adjusting them in order to get circulation of steam;

If you are anxious to save the time which you now spend adjusting these valves and wish to rid yourself of the annoyance of these complaints;

Then we will supply you a Dunham Air Line Valve for sixty days Free Trial. *Write To-day.*

Put the Dunham Valve or Radiator Trap in the hardest service. Years of satisfactory service has proven its Sterling Worth.

Ask for New Catalog Bulletin.

C. A. DUNHAM CO., Limited, Toronto, Can.

Halifax Montreal Ft. William Winnipeg Calgary Vancouver

Sales Over Five Million Dollars Annually

Four Babbitt Manufacturing Plants

TORONTO LONDON, ENG. NEW YORK ST. LOUIS

Faultless "A" This babbitt is a high grade copper hardened alloy, possessing in a higher degree all the good points of the original Genuine Babbitt, with increased antifriction qualities, having the additional merit of absorbing and holding oil. It is used extensively in France for automobile engines, and in South Africa for mining machinery, and in United States and Canada for marine engines, dynamos and all heavy duty machines. Where heavy service is required this will last longer than any Genuine Babbitt manufactured. For heavy duty, saw mills and engines it is without equal.

Eagle "A" Thousands of tons of this alloy have been placed on the market, giving such perfect results, that it's name and merits are known, we believe, as extensively as any other babbitt manufactured. Its high antifriction and heavy duty qualities make it especially adapted for saw-mills, planing-mills, threshing engines, traction engines, pumps, rolling-mills and general machine shop use.

HOYT METAL COMPANY

TORONTO OFFICE AND MFG. PLANT—EASTERN AVE. AND LEWIS ST.

JENCKES Boilers

LOCOMOTIVE TYPES | HEATING BOILERS | HORIZONTAL TUBULAR | VERTICAL TUBULAR

The sort of boilers that, at the end of thirty years' service, are still going strong.

"Jenckes Construction" stands for all that is best in manufacturing boilers. Materials, workmanship and manufacturing equipment are the finest that money can buy or modern engineering skill devise.

The product—The Jenckes Boiler—has gained for us a high reputation amongst steam users everywhere.

Write for Catalog.

The Jenckes Machine Co., Limited

Sherbrooke Montreal St. Catharines Toronto Cobalt South Porcupine Nelson Vancouver

Works: SHERBROOKE, QUE. ST. CATHARINES, ONT.

It's this Full Width Header that Gives Unrestricted Passage to the Steam Drum. This Means Perfect Circulation in the

Robb
Water Tube Boiler

In this type the areas of passages at *every point* are ample for the volume of water, or water and steam which must pass that point.

Some boiler makers claim good circulation, but they evidently overlook the fact that a mixture of water and steam requires a larger passage than water alone. And how can a volume from nine to eighteen tubes pass through a single tube of the same size without seriously retarded velocity?

International Engineering Works, Ltd.

So. Framingham, Mass. **Amherst, N. S., Canada**

39-54

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Grain Exchange Bldg., Calgary.

641 York St., Edmonton.

816 Burrard St., Vancouver.

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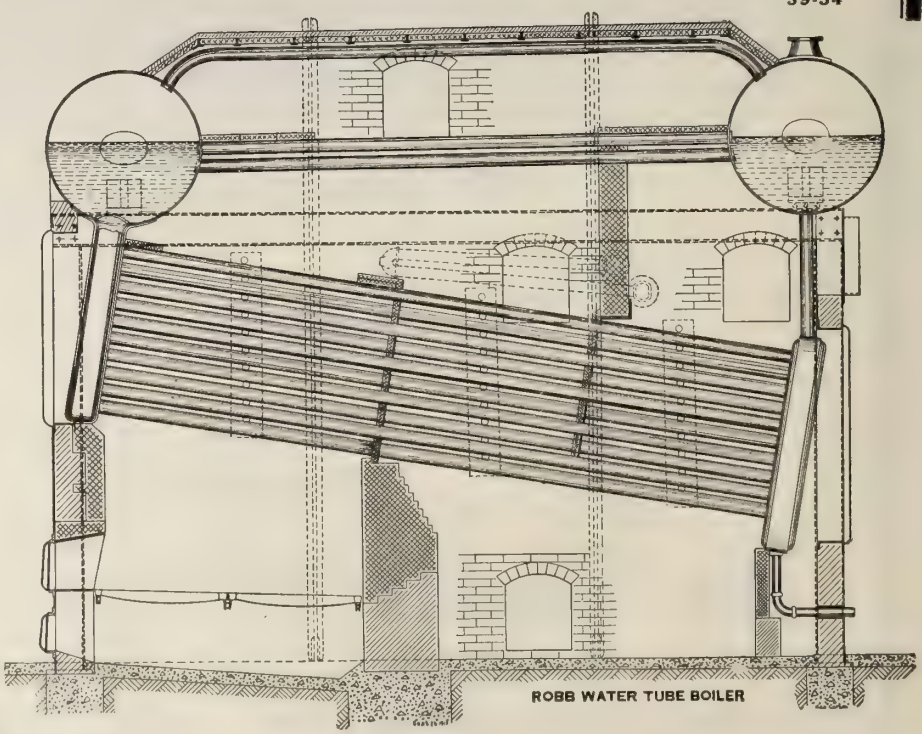
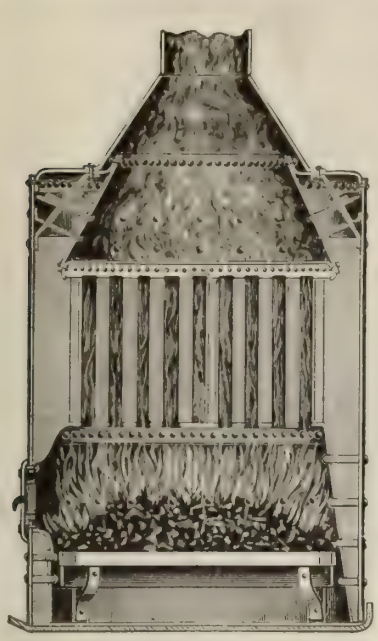
Grodwards Co., Cobalt, Ont.

Ask for Bulletin 6



ROBB WATER TUBE BOILER

The advertiser would like to know where you saw his advertisement—tell him.



You Will Benefit By

a thorough investigation of our boilers.

They are the result of long experience, best materials and expert supervision.

Look up the past and present record of our boilers.

We will take the greatest pleasure in getting you in touch with some users—the evidence of users will cost you nothing. Our boilers will do the same for you as they do for others.

WRITE TO-DAY.

We build various types:

Scotch, Clyde, Fitzgibbon, Vertical, Mosher.

Highest Grade BOILERS

Horizontal, Tubular, Vertical, Locomotive Type, "Heine" Water Tube.

Polson Iron Works,

LIMITED

Steel Shipbuilders, Engineers and Boilermakers

TORONTO, CAN.

Representatives in Canada for

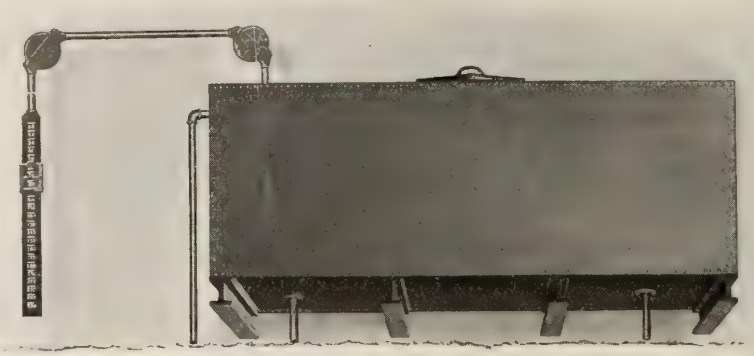
The B. F. Sturtevant Co., Hyde Park, Mass., U.S.A. Fans, Blowers, Heating and Ventilating.

The John I. Thornycroft Co., London, Eng., Marine Motors.

So Many Engineers Are Using Bowser Oil Purifying Systems

That probably you know all about them. If you don't, send for our new catalogue which will give you some valuable hints on oil filtering and the care of bearings in general.

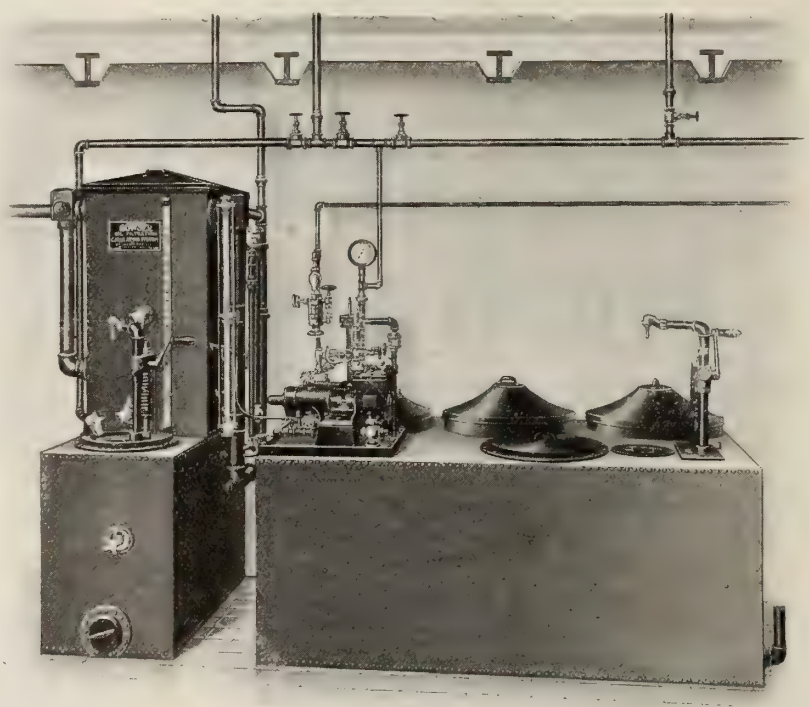
All engineers agree that Area, Precipitation, Capacity and Resistence of filtering medium are the three most important things to consider in an oiling system.



A Bowser Gravity Tank with Storage Indicator.

1st. — Area and Fineness of Straining Surface. The Bowser Strainer is built in a vertical position and on account of this upright construction we are able to get a larger surface. Consequently, we can successfully use a very fine mesh strainer—finer than anything ever used before.

2nd.—Precipitation, Area and Capacity. We embody in our filter 12 shallow precipitation pans, which increases the settling surface of our apparatus almost 16 times.



3rd. — Area and Resistence of Filtering Medium. Each Bowser Filtering Section is 60 inches in circumference and over 12 feet long. Every inch or part of this fine, closely woven cloth is exposed to the oil at all times. On account of our telescopic method of folding this cloth into a space of less than 5 inches, we provide a filtering surface of 2¾ feet for every gallon of oil to be filtered. We make filters with capacities of from 10 to 10,000 gallons or more per day. And the space occupied is so small it is hardly conceivable for the work accomplished.

Illustration shows one type of a Bowser Oil Filtering and Circulating System. Prices, Sizes and Styles to exactly meet your needs. Remember, that a price on all Bowser Filters includes the complete system, ready to go to work, saving oil. There is not an additional price for the Gravity Tank, the Power and Self-Measuring Pmups, Pipings, Valves, Fittings, Water Ejectors, etc.

With a Complete Bowser Oil Filtering and Circulating System you can save 70% of your present oil bill. It requires no special attention as it is entirely automatic and will pay for itself in its saving of oil alone in a very few months—costs nothing to operate and nothing for up-keep. You may in time have to buy another engine—but your Bowser will never wear out.

S. F. BOWSER & CO., Inc.,

66-68 Frazer Avenue **TORONTO, CANADA**

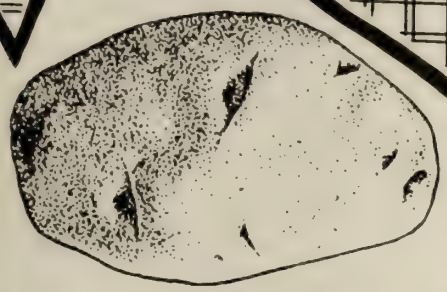
Made by Canadian Workmen and Sold by Canadian Salesmen

Sales Offices in all Centres and Representatives Everywhere.

Original patentees and manufacturers of standard self-measuring hand and power driven pumps, large and small tanks, gasolene and oil storage and distributing systems, self-registering pipe line measures, oil filtering and circulating systems, dry cleaner's systems, etc.

Established 1885.

POTATO SCALE



James Watt was very adverse to high pressure steam—and no wonder. His boilers were made of wood sheathed lead or copper, and were not meant for anything above 2 lbs. per sq. inch. So scale to "James" did not mean anything very serious. But nowadays we're up against a different sort of problem. Our high pressures, and compact quick steaming boilers, mean tubes—any amount of them. And scale around those tubes is a serious matter. True, you can keep a boiler clean by scurfing it, but prevention is better than cure. Getting after the feed water is the logical method of scale prevention.

Potato Scale Boiler Cleanser is the one real boiler compound. It can be made to correct any degree of feed water impurity. It will clean a boiler far better than you can scurf it—and it will keep it clean and prevent pitting.

Send us a gallon of your feed water—we'll analyse it and prescribe the right "Potato Scale" Treatment.
But do it now, delay means precious money wasted.

C. C. SNOWDON

1810-1840 11th STREET EAST, CALGARY, ALBERTA
P. O. Box 1384

Refiner, Importer and Manufacturer of

Pennsylvania Lubricating and Refined Oils, Gasoline, Potato Scale Powder, Liquid Soap, Disinfectants, Polish, Waste, Oil Tanks, etc.

Stop Blow-outs and Leaks in Pipe Lines by Using GOETZE No. 2 ELASTIC GASKETS

If you start right now to renew with No. 2 ELASTIC GASKETS, you can steadily reduce your renewals until you have brought them almost to the vanishing point.

This is not a mere "claim"—it is backed up by a *guarantee*—in fact the strongest guarantee ever made by a gasket manufacturer.

Think what it means to re-gasket a joint so it will *keep tight for years,* instead of days or weeks. Think of the saving resulting in gasket costs, labor and shut-downs.

What No. 2 Elastic Gaskets Will Do

No. 2 ELASTIC GASKETS will make the most troublesome joint you have absolutely tight — and keep it so. They "stay put" and stay tight. Prevent leaks, blow outs and shut-downs. Will practically eliminate renewal expense for gaskets.

No. 2 ELASTIC GASKETS are for high pressure and super-heated steam lines, but owing to their indestructible nature, are equally adapted to *any and every condition* about a factory, mill or refinery.

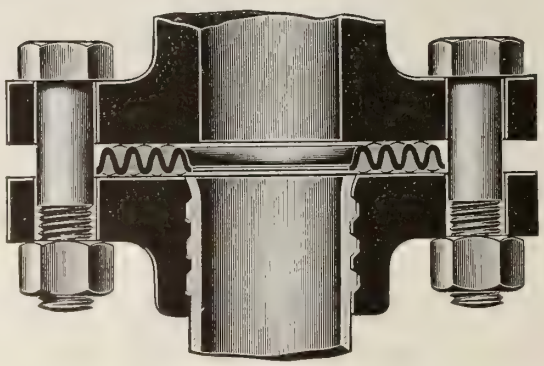
The No. 2 Elastic Guaranteed

Every No 2 Elastic Gasket is Guaranteed for 5 Years Continual Service in the Same Joint

There are no "ifs and ands" about this guarantee. It means just what it says. It applies to every No. 2 GASKET whether bought direct from us or through a dealer.

How No. 2 Elastic Gaskets are Made

These Gaskets are made of corrugated copper with asbestos lining No. 2. The corrugations allow for expansion and contraction of the pipes, while the asbestos, being forced into the



pores of the metals in the flanged surface by the "squeeze" and the constant pressure of the corrugations beneath it, holds securely against the highest pressures.

Goetze Gaskets are carried in stock by

T. McAVITY & SONS, LIMITED

ST. JOHN, N.B.

MONTREAL
112 St. Peter Street

BRANCHES AT
WINNIPEG
C. E. Chown, 147 Bannatyne Street

VANCOUVER
c/o A. O. Campbell, 1069 Hamilton Street.

MANUFACTURED BY

Goetze Gasket & Packing Co., New Brunswick, N.J.

The advertiser would like to know where you saw his advertisement—tell him.

HOW TOM MADE GOOD

A Short Story For Engineers

WELL, Tom, what's the matter with the steam this morning. The Boss has been after me, says he must have more power, extra orders have come in for goods, and I want to start up one of the electric units to operate the small machines. What is the matter with these boilers? They are rated at 150 H.P. each, but you are not getting 75 H. P. each in the engine room."

Tom wiped the perspiration from his face and said:

"I am doing the best I can, Jim, but can not keep up the pressure you want. You know you would not let me shut down to clean the boilers last Sunday, and I could only get at one of them. I found it badly sealed, and did not have time to cool it down to get in to clean it."

"Well," said Tom, "I suppose scale is the trouble as usual. You say every ⅛-inch scale will cut down the steam evaporation 30%. You will have to force these boilers and use the forced draft. Even then, I don't know what we will do when the lights go on late this afternoon. We must have more 'juice' for that. You must get the scale out some way. What's the matter with that boiler compound I ordered last week?"

"I don't know, Jim. It does not seem to work this week like it did last week. No scale or mud came out in the blow-off, and the scale is thicker than ever. It must be that our water has changed. I told the compound salesman when he was here the other day that this compound was no good now, and he told me I would have to send them another sample of water. This will make the third sample I have sent them, and they have changed the compound each time, and then we had to wait a week for it. I will have to turbine the tubes, and that means shut down one boiler at a time for two days at least and hard work for me. I wish I could find something to stop this scale trouble entirely, something that will take the scale off mechanically while the boilers are in use, and keep it off."

"That would be ideal," said Jim, "but you can't find such a thing, so get to work, and force them up, and on Sunday you will have to work all day on scale."

The next Sunday found Tom and a helper at work all day while the other factory hands were enjoying their day of rest, and notwithstanding their hard work, only a very small part of the scale was removed.

Tom that night had a call from a brother engineer, a member of his lodge, and after reciting his experiences of the day, his friend Dan said:

"Tom, I know what will do the trick. Your 'Super' says you can not find anything to clean the boiler and keep it clean. You tell him you can make good, as I have with my boilers. I will send you a man who made me a proposal to send me enough of a liquid preparation at his own expense and risk, to remove the scale, and then cover all the exposed surface of the metal with a protective coating to prevent new scale from forming and at the same time keep the metal free from all corrosion and pitting.

"My boilers were pretty bad, and when the inspector examined them lately he told me they were beginning to pit, and the shell was also showing some signs of grooving and that he might have to cut down my pressure at the next examination, so I decided to take up the proposal for a trial for 60 days, as there was to be no pay provided it did not work as guaranteed. The guarantee also included that there would be no harm to the boilers, and that the preparation would not affect the water in any way.

"As we use condensation for ice mak

SCALE REMOVED BY "PEROLIN"

ing and cooking, the latter guarantee was very important, so I signed the trial order, and installed the feeder they sent with the preparation, which they call PEROLIN, the name they said meant 'perfectly pure and clean.' They sent me full instructions and report blanks to be filled out every two weeks, when I was to let down the boiler and let it cool off before drawing out the water, then open up for examination.

"At the first shut down I found quite a lot of scale had come off. The stuff seemed to work as they said it would, in a mechanical way, that is, it worked in through the cracks in the scale and got between the scale and the metal; or where the scale was heavy, between the layers. Something in the preparation had great expansive force, so that it broke the scale loose, and I took out a lot of it, also a lot of sticky mud, besides what had come out through the blow-off. This mud I found to be the solids in the water that would have been scale at the next washout.

"At the second washout at the end of four weeks I took out a lot more, but there was still some spots not at all clean, but loosening up. I sent in my No. 2 report and the agency that handled the Perolin wrote me that they wanted to see all of the scale come off and sent me more of the stuff, and I kept up the trial. At the third examination I found that all of the scale had come off, and all the exposed metal surface was coated white, like whitewash. I had noticed this white appearance on the metal before, which I found prevented any new scale forming. When I reported this condition they wrote me that I could now cut the dose I was using to one-half the amount, and at the fourth report they told me to cut it again. I had started at one quart per 100 H.P. and now at the end of 60 days I am using one-half pint per 100 H.P. and I will keep it up that way as a permanent maintainence charge.

"The boiler inspector dropped in one day when I had the boiler open, and he congratulated me and said he thought there would be no more corrosion or pitting and that I could keep up my pressure for years to come. When I reported all this to my boss and made him realize all that it meant to him, and that I was burning much less coal and had all the steam I wanted, and there was no danger of a shut down for boiler repairs, he gladly sent his check for all the stuff sent on trial, and gave an order for a supply for some time to come. You see this is different from any boiler compound, as it does not treat the water, and does not have to be changed with the change in the feed water, or the full dose kept up for all time. Besides all compounds will not prevent corrosion or pitting, and again I found that the whitewash coating is a good heat conductor and adds to the evaporative efficiency of the boiler. So no more Sunday work or mechanical cleaning for yours truly."

When Dan had finished his story, Tom said:

"Send your man to me as soon as possible. I want to sign up such a proposal and see if I can make good."

"I will do it," replied Dan, "but remember you must follow the instructions given you exactly. You may think you can feed it in the same way as any compound, or not take a little trouble to rig up the feeder as they tell you to, or blow-off just before feeding, or get the dose all at once into each boiler, from a point as close as possible to each boiler, or not take the pains to see that the feed is at a regular time, and no blow down between feeding, also to remove all scale and mud at each washout. You may get some results if you follow your own way, but not the full 100% you can get if you follow instructions. Also what is important is to let your boilers down cold at each examination. If you can not spare the boilers long enough to let the boiler cool down before drawing off, blow down one or two guages of water and fill up again with cold water, until the metal is cool before drawing all the water out. You will see the reason for this, because the scale which is loose and ready to drop off, or easily scraped off if the metal is cool, will be baked on to the metal again, if it is hot when the water is out, and you have got to do the work all over again at the expense of more PEROLIN and a longer time of sealed boilers."

"Thank you," said Tom. "I will take all you say and try it, as I am willing to go to a little trouble to save a good deal."

The next day Tom repeated all Dan's story to the "Super," and together they told it to the Boss, who said it sounded good to him, but he had been fooled so often that he said, "Tom, I am going to put it all up to you, and not only will you have more time to yourself, but it will be a saving to me as well as an extra insurance on my boilers, and I am willing you should have your share."

Tom got the stuff, followed closely the instructions, got the results just as his friend had, got his reward in an increase of salary, had no more dirty Sunday work, and was "happy ever after."

PEROLIN made good, because Tom made it work good.

MORAL. What Tom did, any engineer can do with PEROLIN, the German Metal Treatment for Steam Boilers, it will always make good if used right. Try it. Send for the guarantee proposal on PEROLIN to any of our distributors.

Perolin Company
of Canada, Limited
Standard Bank Bldg., Toronto, Ont.

¶ The Progressive Engineer benefits by specifying

GARLOCK PACKINGS

among his Engine Room Supplies, because he is guarded against:—

Sunday work and overtime on his Engines and Pumps; Loss and delay by reason of wasted steam; Shut downs for repairs, etc., by using Packing of **Known Reliability.**

¶ Deception in the manufacture of packings is easily accomplished and your only protection is to place your confidence in the Packing that for many years has been accepted as *standard* the world over.

¶ Cheap packing always means inferior material, and poor workmanship in its construction.

¶ *Garlock Packing* is not "cheap," but always proves economical to its users. We stand ever ready to back up our claims by allowing our customers ample opportunities to thoroughly test our packings.

Write to-day for the Garlock catalog. It's interesting.

The Garlock Packing Company

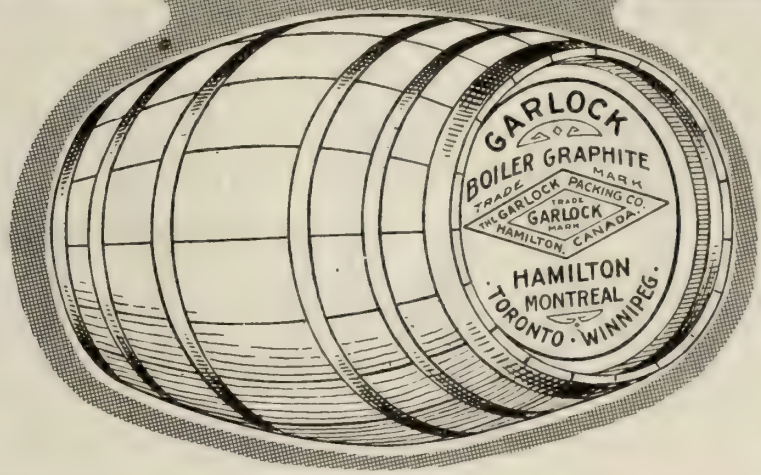
HAMILTON, ONTARIO

Winnipeg **Toronto** **Montreal**

"Pioneers in the Packing Business"

The Firm That Put the "phite" in Graphite

Garlock
BOILER GRAPHITE



One of the Most Successful Scale Fighters on the Market.

It's the Method of Attack that Does the Trick.

It circulates with the water through the boiler, will attack, soften and so disintegrate old scale that it may be easily removed, and will impart to the steel of the boiler a graphite finish on which new scale will not readily form. What little does form will be soft and so mixed with graphite as to be easily removed.

There is a mechanical—not a chemical action. It will not injure the tubes in the slightest degree.

By using Garlock Boiler Graphite you will increase the efficiency of your boiler, reduce fuel bills and easily clean your tubes.

To prove the effectiveness of this boiler graphite, we will send you a barrel on 60 days' trial. Keep it if you like it. If not satisfactory at the end of this trial period, return the unused portion at our expense and there will be no charge for quantity used, nor expense to you in any way.

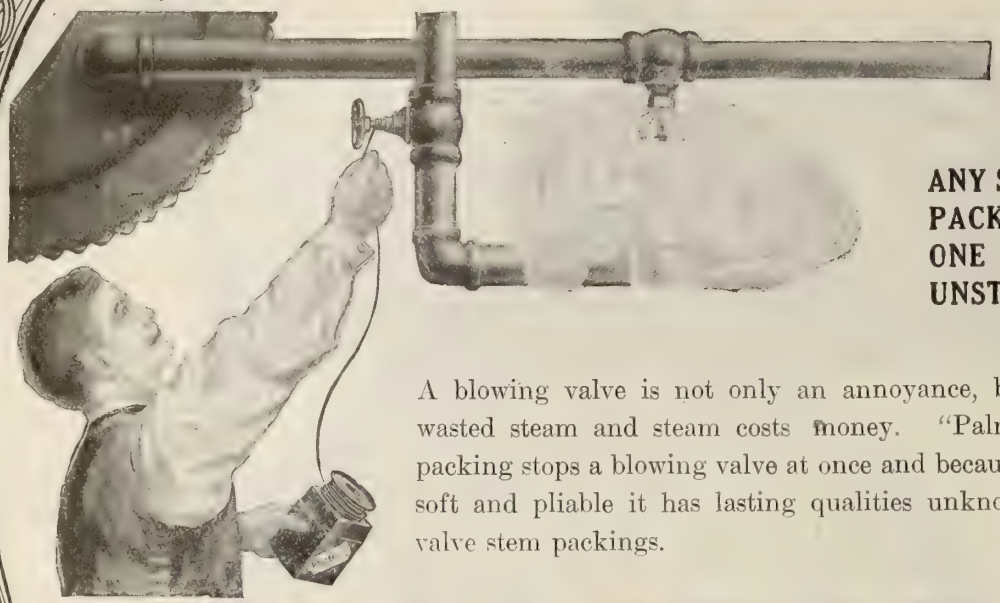
Fair Proposition?

The Garlock Packing Co., HAMILTON, ONTARIO

MONTREAL TORONTO WINNIPEG VANCOUVER CALGARY

The advertiser would like to know where you saw his advertisement—tell him.

You Don't Neea To Worry About Leaky Valves



ANY SIZE VALVE PACKED FROM ONE SPOOL BY UNSTRANDING.

A blowing valve is not only an annoyance, but it means wasted steam and steam costs money. "Palmetto" Twist packing stops a blowing valve at once and because it remains soft and pliable it has lasting qualities unknown to other valve stem packings.

"PALMETTO"

REG. TRADE MARK

PACKING

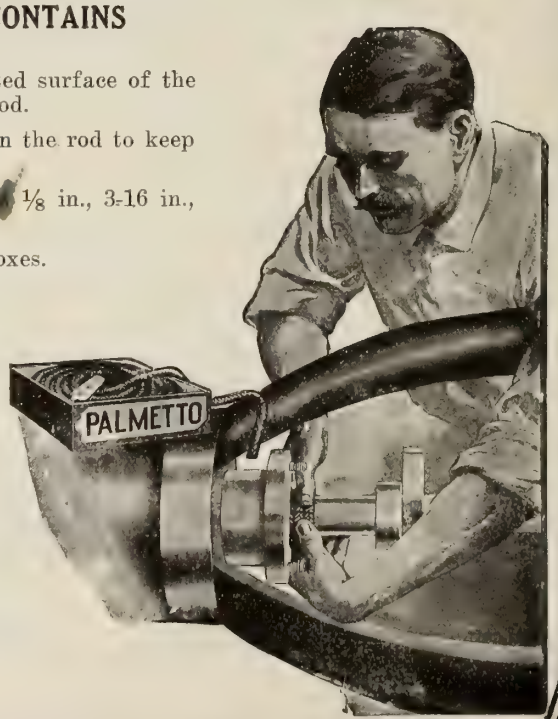
IS KEPT SOFT AND PLIABLE BY THE QUANTITY OF GRAPHITE GREASE LUBRICANT IT CONTAINS

The rod slips without resistance over the well lubricated surface of the packing, prolonging the life of both the packing and rod.

With "Palmetto" it is not necessary to put friction on the rod to keep stuffing-box steam tight.

TWIST on 1-lb. tin spools in individual boxes, sizes ⅛ in., 3-16 in., and ¼ in.

BRAIDED, round and square, from ¼ in. up, in 5-lb. boxes.



Send for Free working samples.

Greene, Tweed & Co.
Sole Manufacturers.
109 Duane St., New York.

Canadian Distributing Agents.

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

St. John Ottawa Montreal Toronto Winnipeg
Calgary Saskatoon Victoria Vancouver

Let the Postman Hand You this Book—FREE

In these days of "scientific management" of offices and shops, the men who are paid the most are the men who know most. This is also true of engineers.

"The Slide Valve," an illustrated book on valves of many types, will help make you a better engineer. Let us send you a copy absolutely FREE. See the coupon below.

Another big aid to economy of cost and time is our famous P. P. P. Packing the kind that is built on scientific principles, and has been proved out by a number of scientific tests and by use of thousands of cases of actual use.

DANIEL'S ROD PACKING P. P. P. COIL RING SPIRAL

Most packings depend on expansion, due to heat or moisture, to keep them steamtight, or the gland is set up tight as a vise against the packing, thereby jamming the packing against the rod to such an extent that the packing quickly wears out, and with it, in time, the rod itself.

P. P. P. bears on the rod only during the backward stroke and then only sufficiently to hold steamtight. As the steam decreases the pressure through expansion, P. P. P. lessens the bearing on the rod correspondingly.

P. P. P. is the only packing whose claims are backed with scientific proof. Don't be deceived by packings which imitate the form of P. P. P., or whose makers copy our advertising. There is only one packing that gives maximum results in economy of time and cost, and that packing is Daniel's P. P. P.

How to Get the "Slide Valve" FREE

Fill out the Coupon, and mail it to us. We will address a book to you, and send it FREE of charge.

Your Name .....

Address .....

Employed by .....

Address .....

Horsepower of Engine .....

Kind of Rod Packing Used .....

Do You Use EBONITE Sheet Packing? .....

Dealer's Name .....

Address .....

Name of Buyer .....

..... Series 24-K

DANIEL'S P. P. P. ROD PACKING

is imitated more than any other packing made. But the imitation is in appearance and claims only. None but the genuine gives the results.

QUAKER CITY RUBBER COMPANY

Manufacturers of Mechanical Rubber Goods

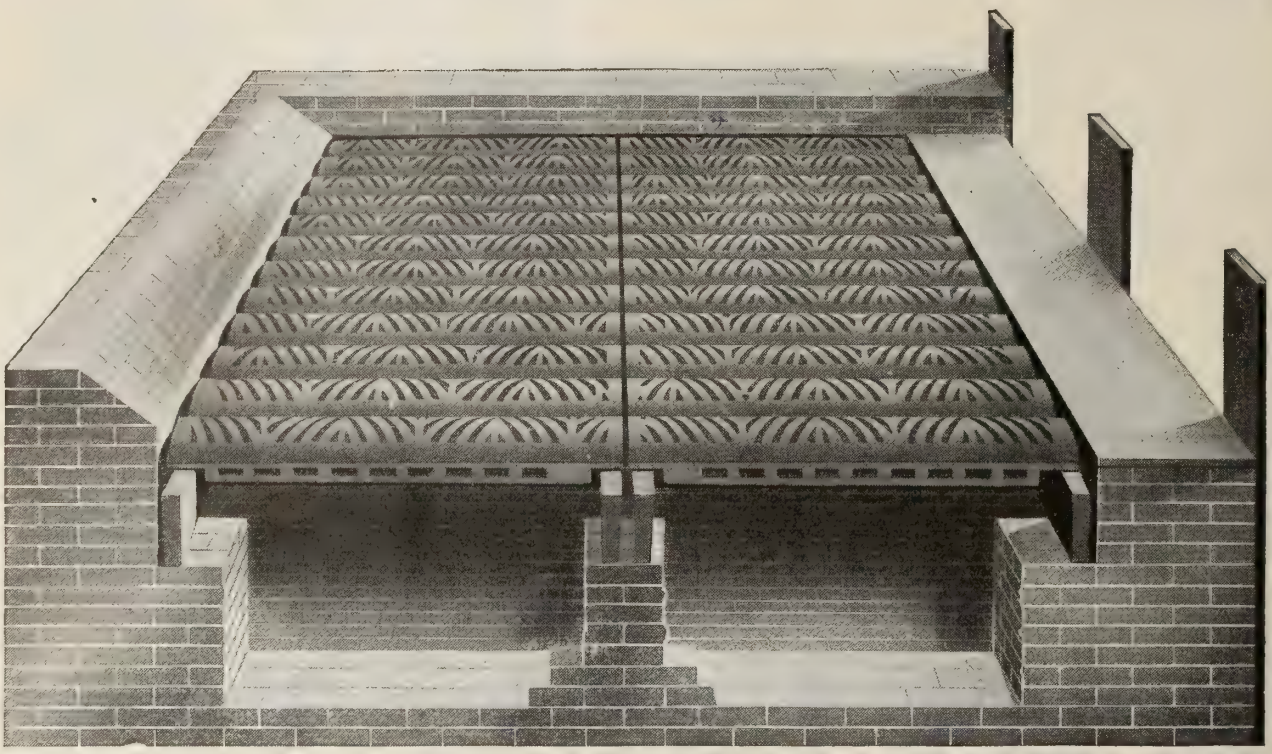
PHILADELPHIA	CHICAGO	PITTSBURGH	NEW YORK
629 Market St.	182 W. Lake St.	207 Wood St.	207 Fulton St.

The advertiser would like to know where you saw his advertisement—tell him.

THOMAS ELLIPTIC GRATE BARS

SHAKING—CIRCLE—STATIONARY

FOR EVERY FUEL



THOMAS IDEAS

PATENTED

THOMAS ELLIPTIC GRATE BARS	INCREASE STEAM—SAVE FUEL—SAVE LABOR —COST LESS—REDUCE SMOKE.
THOMAS GRATE RESTS	EVERLASTING—PRESERVE GRATE BARS—PROTECT FIRE WALLS.
THOMAS FURNACE SETTING	FIRE WALLS—BRIDGE WALL—FRONT WALL independent of all expanding and contracting irons. SEE THAT AIR SPACE COMPLETELY ENCIRCLING THE GRATE AREA. No dead and burned grate bar ends. No pushed down walls from expansion of grates.

Shipped from Hamilton, Ont. **Let us give you complete information.**

FOR ALL PROBLEMS

Steam—Grate Bar—Furnace—write THOMAS

The General Supply Co. of Canada, Ltd.

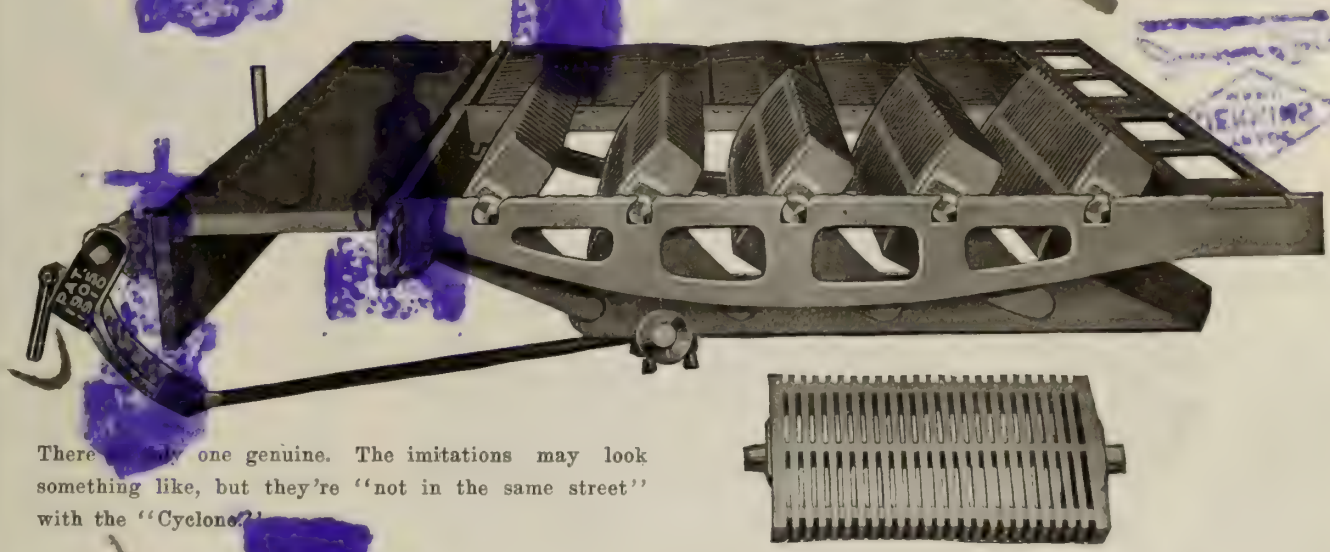
OTTAWA TORONTO WINNIPEG

THOMAS GRATE BAR CO., **Birmingham, Ala., U.S.A.**

"THE Cyclone"

Shaking and Dumping Grate Bar

Let Its Users Tell You!



There is only one genuine. The imitations may look something like, but they're "not in the same street" with the "Cyclone."

Go, ask any man who has installed the "Cyclone." Ask **him** to tell you frankly what he thinks about it; to tell you of the economies it has effected for **him**; of the way it stands up to its work.

The Cyclone shaking and dumping grate bar makes possible the use of low grade fuel with a minimum of smoke and a maximum of heat efficiency.

The improved shaking mechanism gives vigorous agitation into the least amount of effort on the part of the fireman, and ensures **all** clinkers being shaken through into the ash-pit.

Let us put you in touch with some satisfied users.

The Canadian Steam Boiler Equipment Co., Limited

SOLE MANUFACTURERS FOR CANADA

211 QUEEN STREET EAST :-: :-: :-: **TORONTO, CANADA**

AGENTS

ST. JOHN, N.B., F. W. Blizard, Canada Permanent Chambers. MONTREAL, H. L. Peiler & Co., 308 St. James Street.
HAMILTON, Robt. Fitzsimmons, 8 Grove Street. CALGARY, Alta., The Western Foundry & Metal Co., Limited.
BERLIN, J. Hainsworth, 14 Foundry Street. WINNIPEG, Vulcan Iron Works.

The advertiser would like to know where you saw his advertisement—tell him.

Look For The Diamond Trade Mark

It's the First Rule of Good Valve Buying.

JENKINS BROS'. Valves have a host of imitators.

It pays to insist upon getting the genuine. Because it is only with genuine JENKINS BROS' VALVES that you are sure of the service which has given these valves their reputation.

The appearance of JENKINS BROS'. valves can be copied, but the service goes only with the original.

It is easy for you to get the genuine. Ask your dealer. And look for the Diamond Trade-Mark.

A catalog showing the complete line of Jenkins Bros. Valves sent free on request

JENKINS BROS., LIMITED

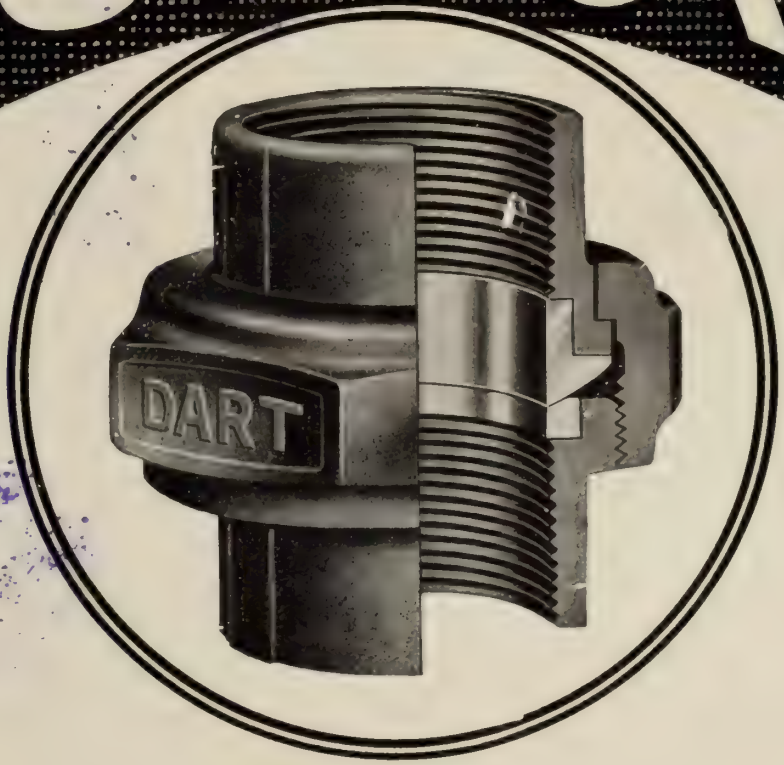
103 St. Remi Street MONTREAL

The advertiser would like to know where you saw this advertisement—tell him.

PIPE COUPLINGS

DART UNION

The Union that is Efficient



Bronze to Bronze at the joint

There are no leaking joints on the piping where Dart Unions are used. This condition not only saves in the up-keep cost of pipe, but it is a positive protection against damage being done to finished product and equipment by the constant drip, drip, drip from union leaks. You know damage caused by drips is often exceedingly costly.

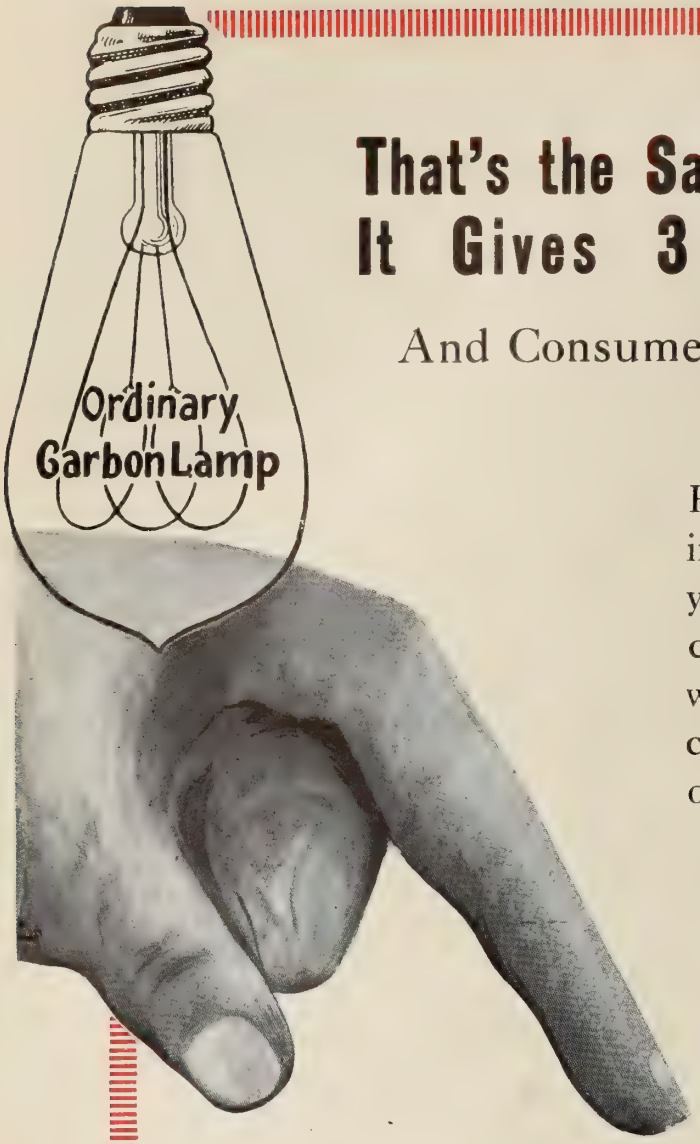
Once Dart Unions are connected all cost is ended—they never need to be replaced and are trouble-proof.

What you need to do is to get "Dart" Unions, put them into use and watch results. You will soon realize that they are exactly as we claim—permanently tight and economical.

We guarantee to replace 2 for 1 any "Dart" that is found defective.

Jobbers from coast to coast sell them.

Dart Union Company Limited, Toronto, Ont.



That's the Same Size Lamp But It Gives 3 Times the Light

And Consumes No More Current

Put a Sunbeam Mazda in every socket where you are now using the carbon lamp and you will ensure daylight efficiency to all twilight operations.

The SUNBEAM Mazda

Sunbeam Mazda Lamps are not affected by vibration—they are strong and durable.

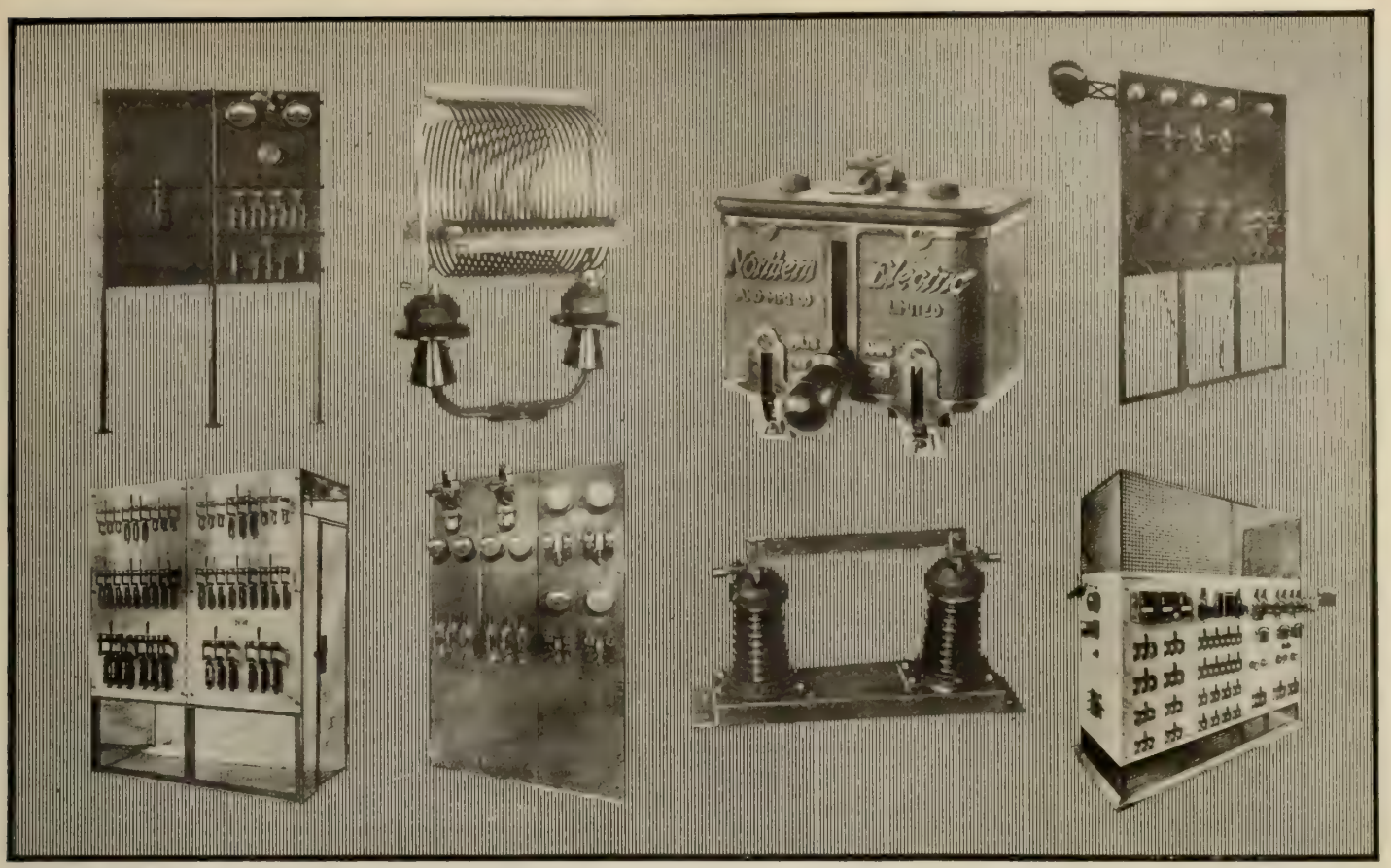
We carry a large stock from which we can ship immediately.

Satisfaction Guaranteed

The Canadian Sunbeam Lamp Co., Ltd.

Main Office and Factory: TORONTO

Branch Warehouses: Montreal Winnipeg Calgary Vancouver



Switchboards Disconnecting Switches Choke Coils Circuit Breakers

Designed to Suit Any Special Requirement

When special apparatus is required for electrical work of any kind we can always supply your needs.

If necessary we will design special equipment for your particular requirement.

Our staff of experienced engineers is at all times at your service.

Consult with our specialist at our nearest house or write for information. This will not obligate you in any way and we will be glad to help you.

THE Northern Electric AND MANUFACTURING CO. LIMITED

Montreal Halifax Toronto Winnipeg Regina Calgary Edmonton Vancouver Victoria

The advertiser would like to know where you saw his advertisement—tell him.

Across Canada

with the

IMPERIAL WIRE and CABLE COMPANY, LIMITED

Toronto MONTREAL Winnipeg

Fifth of a series of advertisements showing buildings of national importance which have been wired with the Imperial Wire and Cable Co.'s Limited, wires.

This picture shows the

C. P. R. HOTEL, CALGARY

This building was wired with "Adanac" Rubber Insulated Wire.

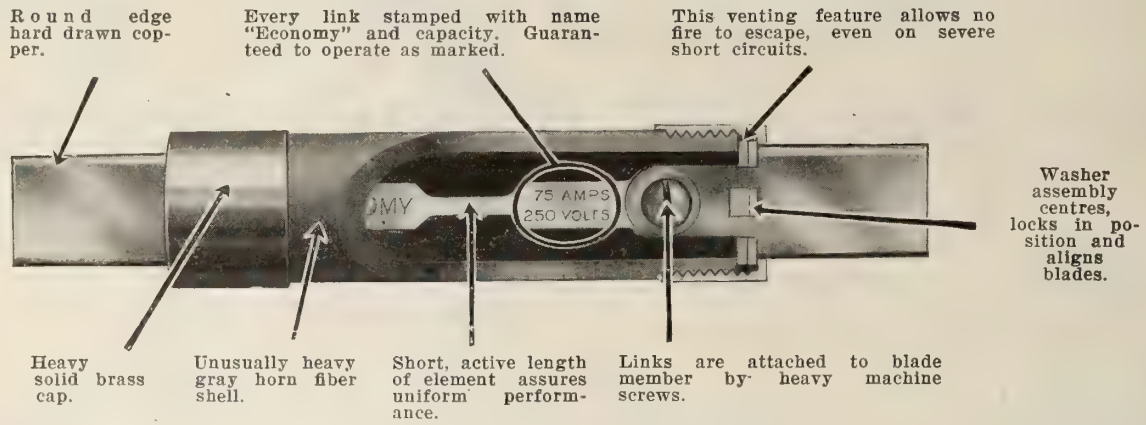
Architects and Engineers—E. & W. S. Maxwell, Montreal.
Electrical Contractors—Parker-Chase Electrical Construction Company, Calgary.

Address enquiries to nearest office

MONTREAL TORONTO WINNIPEG

Enquiries from Alberta and British Columbia may be addressed to Northern Electric & Manufacturing Co., Limited, Calgary and Vancouver.

"ADANAC," "IMPERIAL HIGRADE" and "30% PARA."


Round edge hard drawn copper.
Every link stamped with name "Economy" and capacity. Guaranteed to operate as marked.
This venting feature allows no fire to escape, even on severe short circuits.
75 AMPS
250 VOLTS
Washer assembly centres, locks in position and aligns blades.
Heavy solid brass cap.
Unusually heavy gray horn fiber shell.
Short, active length of element assures uniform performance.
Links are attached to blade member by heavy machine screws.

Light and Power Companies, Large Corporations, Industrial Plants, Mining and Smelting Companies, Department Stores, Hotels, Office Buildings, Electric and Steam Railroads, Steamships, U. S. Government, and many other classes of users are **reducing fuse Maintenance expense over 80 per cent. by using**

ECONOMY RENEWABLE FUSES

They use Economy Renewable Fuses for these reasons:

First, of course, because it provides a practical method of reducing the fuse maintenance expense more than 80%.
Second, because it is the only renewable fuse that is uniformly rated.
Third, because it is the only design so far produced that provides the desired electrical characteristics.
Fourth, because all capacities of renewal elements are readily available, making large fuse stocks unnecessary.
Fifth, because they never vent fire or hold a sustained arc and are absolutely safe.
Sixth, because they meet the performance specifications governing the use of such devices.

Special Announcement!

Two Economy Renewal Elements are now furnished (without charge) with each Economy Fuse. Now YOU figure what fuse is the cheapest not only to buy but also to maintain.

Write for Bulletin, Prices and Discounts

Economy Fuse & Mfg. Co. of Canada, Limited

Herald Building, Montreal

ECONOMY Renewable Fuses are sanctioned by the Canadian Fire Underwriters' Association.

Will Make Your Lighting System Efficient And Economical

This lamp will stand as much vibration as a carbon lamp and last much longer than other Tungstens.

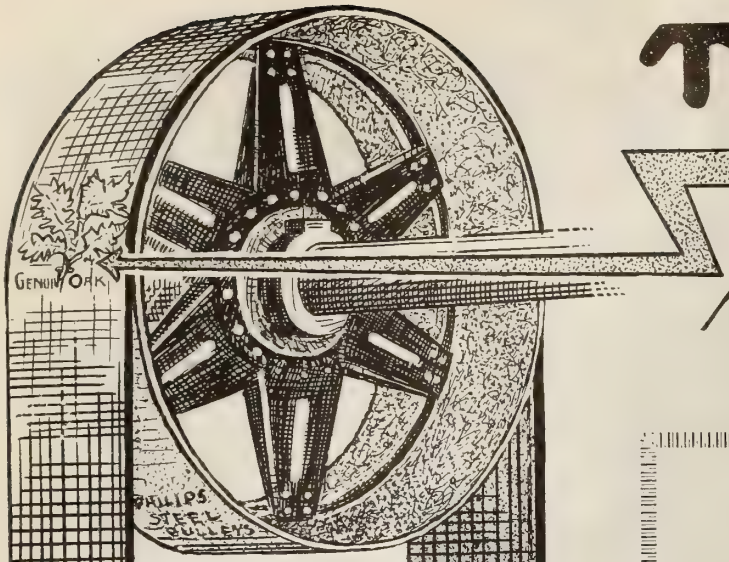
"Nulite" is made from Pure Tungsten Metal drawn into wire form, from which a continuous filament is made.

It is well known that Tungsten Lamps give a **better light with less current consumption** than carbon lamps, and that more work and better work is the result of an efficient light.

Why not improve your lighting system now?

The Canadian Tungsten Lamp Company, Limited
Hamilton, Ontario

The advertiser would like to know where you saw his advertisement—tell him.



The Mark

That Assures Maximum Belt Service

D. K. McLaren's

Genuine British Oak Tanned

Leather Belting

MADE exclusively from close-trimmed butts of the finest selected hides tanned by the old-fashioned but the most effective British Oak Tanning Process.

Through its manufacture from raw hide to finished belt, extreme care is maintained that nothing shall be done or left undone that will compromise the high reputation which **D. K. McLaren's Belting** enjoys in every part of the Dominion.

Users of **D. K. McLaren's Belting** are always free from belting troubles that are inseparable from inferior belts, such as breakdowns, loss of power, slippage, stretch, etc.

Every piece of **D. K. McLaren's Belting** is trade marked. Always get the belting with this mark and you will be safeguarded against troubles and losses.

Let us send our catalog.

D. K. McLAREN, Limited

Toronto
200 King St. W.

Montreal
351 St. James St.

Vancouver
37 Alexander St.

St. John, N.B.
64 Prince William St.

How much coal Do You Waste By poor power Transmission?

Power experts agree that in the average plant only 40% to 50% of the coal pile is eventually employed in running the machinery. The rest is lost.

Inefficient pulleys, or those carrying unnecessary weight, are among the large contributors to power "leakage" and coal waste.

Copyright. American Pulley Co., 1913.

"American" Steel Split Pulleys

Perfect in Principle Powerful in Performance

are the original steel pulleys and embody the latest improvements founded upon correct basic principles. On such a foundation is built the "American" pulley's title of "The Standard of Pulley Efficiency."

"American" pulleys are made in diameters of 3 to 60 inches inclusive.

Discuss your pulley problems with the nearest "American" dealer or—

Patented.

Write for "Factors of Energy"—a useful little book.

THE AMERICAN PULLEY COMPANY

OFFICE AND WORKS, PHILADELPHIA, PA., U.S.A.

Large stocks of "American" Steel Split Pulleys are carried at the following warehouses, insuring prompt shipment to customers.

CANADIAN DEALERS:—Williams & Wilson, Limited, Montreal, Quebec; A. R. Williams Machinery Co., Limited, Toronto, Ont.; St. John, N.B.; Winnipeg, Man.; Calgary, Alberta; Vancouver, B.C.

Use Stephenson Bar Belt Dressing

Make 1913 a record breaking year. Turn over a new leaf and get rid of the things that have been causing needless trouble and expense. Adopt the things which will make your work easier, give better results and save money for your employer. You cannot start at abetter place than with your belt dressing.

Get rid of your troublesome liquid dressing. Shake the can for the Stephenson solid stick and shake trouble at the same time.

Stephenson Bar Belt Dressing is a friend in need. It doesn't require preparation, nor do you have to use special care in applying it. The minute the belt slips you hold the Stephenson bar to the belt for a few seconds and the slipping stops. There's no waste—no slop—no smearing on of paste or pouring on of spattering liquid. And the results are better.

I'll **"Stick to the Solid Stick"**

Start With a Free ½ Lb. Sample

Simply send us your name and address and we ll send you a present in the shape of a free half-pound sample of Stephenson Bar Belt Dressing.

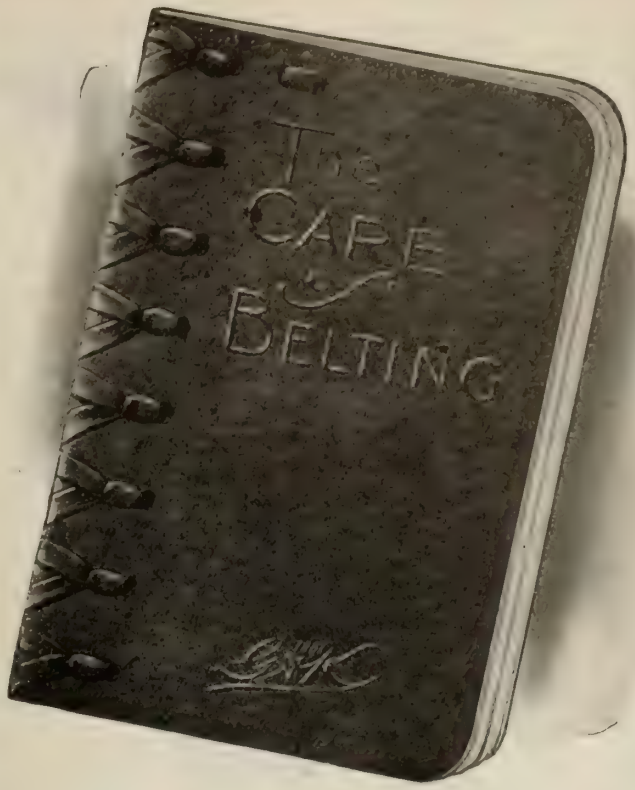
Remember—we give you this sample absolutely free of charge. Get this free half-pound of the finest belt dressing made and test it. Here's your chance to try somesomething really good at no expense.

None Genuine Without Trade-Mark

Stephenson Manufacturing Company

Est. 1888 Albany, N.Y. **Inc. 1897**

The advertiser would like to know where you saw his advertisement—tell him.



Make Belting Do More In Your Plant—

This FREE 40-Page Book "The Care of Belting"

Tells how to obtain the greatest efficiency from leather belting.

Tells how to lace belts.

How to repair the laps of leather belting.

How to make double belts endless on the pulleys.

How to cover iron pulleys with leather.

It contains mechanical rules which tell how to figure the horsepower of belting—how to find the velocity of belting—the width of belting, and the length of belting when it is inconvenient to use a tape measure.

In short, its 40 pages are a veritable fund of information—the kind every belt user should have.

A copy of "The Care of Belting" we will send you without charge. Fill in and mail the coupon—the book will be sent immediately.

The Graton & Knight Mfg. Co.

Oak Leather Tanners and Belt Makers

Suffolk and Norfolk Sts. WORCESTER, MASS., U.S.A.

G. & K. BRANCHES:

Atlanta	Kansas City, Mo.	Pittsburgh
Boston	Milwaukee	Portland, Ore.
Chicago	Minneapolis	San Francisco
Cleveland	New York	Seattle
Detroit	Philadelphia	St. Louis

Selling Agents for Texas,
Graton & Knight Mfg. Co., of Texas, Dallas, Tex.

COUPON. P. H. Nov. 13

Graton & Knight Mfg. Co.,
Worcester, Mass., U. S. A.

Gentlemen:—Kindly send promptly copy of "The Care of Belting" Book.

Name .....

Position held .....

Company .....

Address .....

The advertiser would like to know where you saw his advertisement—tell him.

Bond Maximum Service Hangers

ALL BEARINGS REAMED

TRADE MARK BOND DOUBLE-SURE QUALITY PATENTED

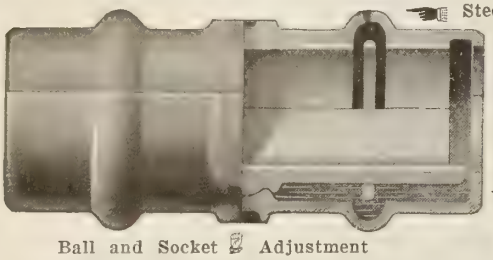
The actual service test has proven Bond Hangers the best.

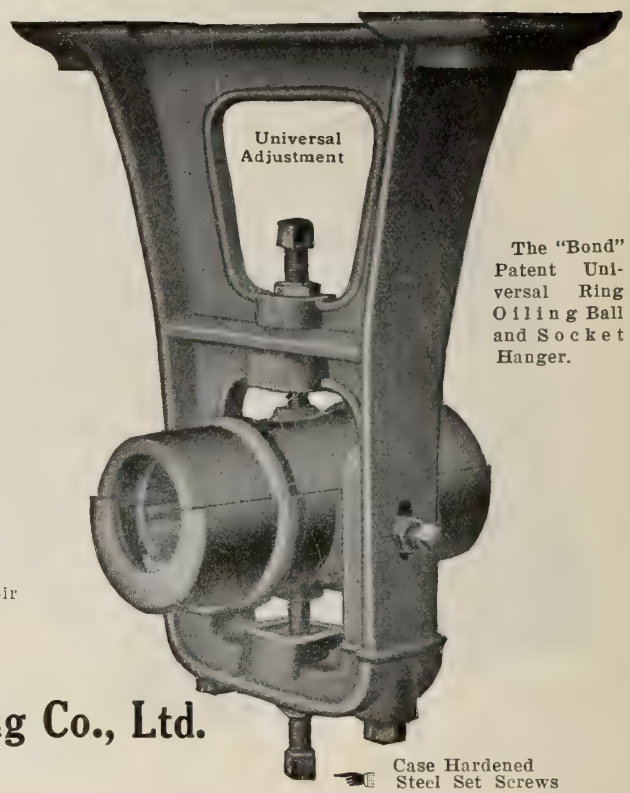
Why not get fully acquainted with their merits?

They save money, time and trouble everywhere.

Ask for catalogue No. 27.

We have everything in transmission.





The "Bond" Patent Universal Ring Oiling Ball and Socket Hanger.

Canadian Bond Hanger & Coupling Co., Ltd.

Alexandria, Ontario

"Maple Leaf" Brand

Stitched Cotton Duck Belting

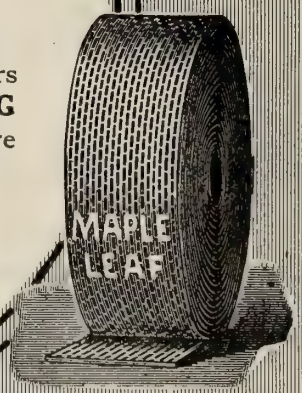
THE BEST FOR ALL KINDS OF BELTS

Means Reduced Upkeep Expense and Efficient Service

TO THE HARDWARE TRADE—

Look over your stock and send your orders in NOW for **"MAPLE LEAF" BELTING** and **BELT DRESSING,** so as to insure delivery within a reasonable time.

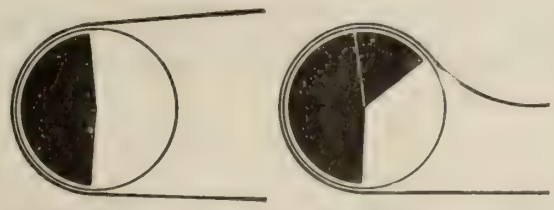
Ask us for further information and prices.



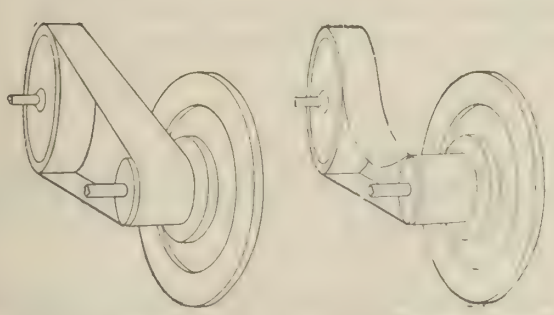
Dominion Belting Co., Ltd.,

HAMILTON, CANADA

This or This?
Tight or Slack?
170° Arc or 225° Arc?
Untreated or Treated?



Without Cling-Surface. With Cling-Surface.



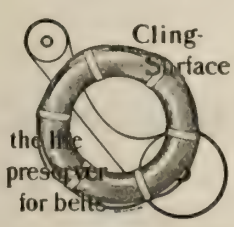
A tight untreated belt. A Cling-Surface treated belt.

The above diagrams made directly from actual installations speak volumes for Cling-Surface. Increased arc, higher pulling capacity for the belt, non-slip, decreased power loss, longer belt life, waterproofing, saving in lubricating oil, saving in babbitt and journals, saving in labor and a great saving of worry, are all obtainable where Cling-Surface is used on belt or rope drives, and only in this degree where it is used.

These **actual results** have been and are daily being obtained in big and little plants all over the world.

Cling-Surface treatment makes a belt pull without making the belt surface sticky. The Cling-Surface goes into the belt to invigorate the fabric, to replace the natural ingredients that become spent in service. It acts just the same as the food you eat to keep up vitality and it is just as necessary to the belt as food is to you.

Send a trial order, or, at least, send for further proof, facts and figures. Quotations are f.o.b. Toronto.



Cling-Surface Co

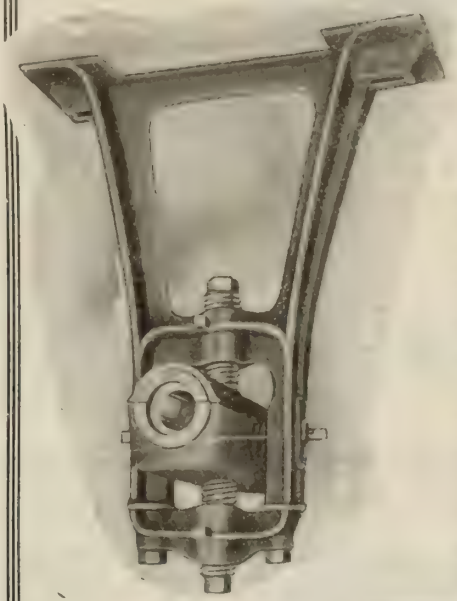
1057 Niagara Street
Buffalo N Y

63

ELMIRA

Ball & Socket HANGERS — **For MAXIMUM Service** — **Wood Split PULLEY**

AND BIG REDUCTION IN POWER TRANSMISSION COST



The "Elmira" Ball and Socket Hanger

is exceptionally strong and heavy. In this hanger a union system of oiling is employed, a combination of centrifugal and capillary attraction, effected by tempered steel rings and woven cotton distribution of lubricant, and precludes the slightest possibility of "Dry Bearings" so long as any oil remains in the reservoir or dry chamber, one filling of which should last from six to twelve months.

The "Elmira" Wood Split Pulley

You can use an "Elmira" Pulley any place that a leather belt will give satisfaction, and know that what any good pulley will do, it will do, and more.

This pulley **stands the hardest and most severe conditions.** It is nailed throughout. The arms are tenoned into rim and dowelled there.

Absolutely guaranteed.

It will be much to your interest to let us furnish you with our illustrated catalog. Write for it to-day.

Large and complete stocks carried at Elmira and by The A. M. Ellicott Co., 301 St. James Street, Montreal, Que., Sole Eastern Agents.

Elmira Machinery & Transmission Co., Ltd.

ELMIRA, CANADA

The advertiser would like to know where you saw his advertisement—tell him.

JONES STOKERS
are Cutting Down Coal Bills

Your coal bill is your biggest single item of expense in the steam plant, whether large or small. A small saving on it will pay a good dividend on the investment, which makes the saving possible. The Jones Stoker actual cut in the coal bill is from 15 to 20 per cent. over previous hand-fired methods.

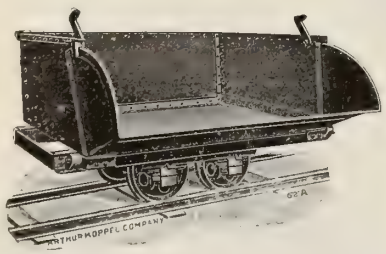
In short, no matter what the angle from which you look at it, no matter what the size of your plant, it has been positively proven that **JONES STOKERS will cut down your coal bill.**

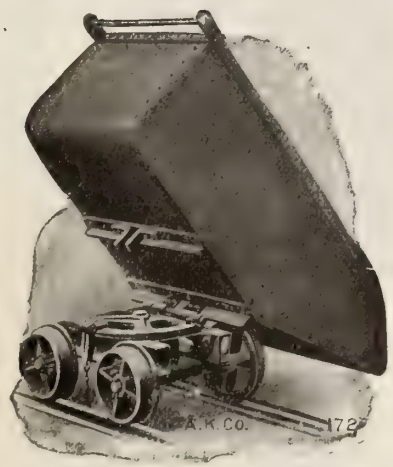
Dress the idea up in whatever words you will — consider it from the point of **complete combustion, smokelessness,** or **automatic control of air and coal, a cut in your coal bill** is the sum total.

Think it over, Mr. Engineer; they're doing it in so many plants.

JONES UNDERFEED STOKER CO., Limited

National Trust Building, TORONTO, Ontario





A VERY satisfactory type of car for use in hauling ashes, dirt, etc., is the Scoop Car, which can be dumped either between the rails or to either side. Standard capacities are 12, 18 or 27 cubic feet for gauges of 18 or 24 inches.

How to Charge Furnaces Economically

A very important factor in the problem of keeping a constant supply of power is that of how to stoke furnaces efficiently. We are selling agents for a system of conveying coal and for charging furnaces in boiler rooms which requires very little labor and is practically indestructible. This system consists of the well known Koppel Cast Plate Track and Charging Cars.

ORENSTEIN-ARTHUR KOPPEL

Coal Charging Cars for the conveying of coal to boiler rooms are made of steel and are very durable. They are light in weight and easy and convenient to operate, being designed with special reference to boiler room service. The height of the cars is such as to make shoveling very convenient for the stoker. They may be supplied either with two side doors or end doors, as desired, and with or without swiveling base.

The rails of the track used in our boiler room systems are cast integrally with solid sectional plates, which provide a level surface to walk upon while car is being propelled.

We have a very interesting catalogue on this subject, showing many installations of the Koppel System, together with illustrations of cars, track, switches, turntables, etc., which we should like to send you. Ask for catalogue 412.

SALES AGENTS

The Canadian Fairbanks-Morse Co., Limited

ST. JOHN QUEBEC OTTAWA MONTREAL
TORONTO WINNIPEG SASKATOON CALGARY VANCOUVER

The advertiser would like to know where you saw his advertisement—tell him.

MURPHY FURNACES

OCCASIONALLY we fail to get first contract; WHEN GET FIRST CONTRACT it is in but RARE INSTANCES WHEN DO NOT GET REPEAT ORDER—when additions are made to plant.

Illustrative of this: THE ST. LAWRENCE STARCH CO., Limited, Port Credit, Ont., bought Murphy Furnaces as follows:

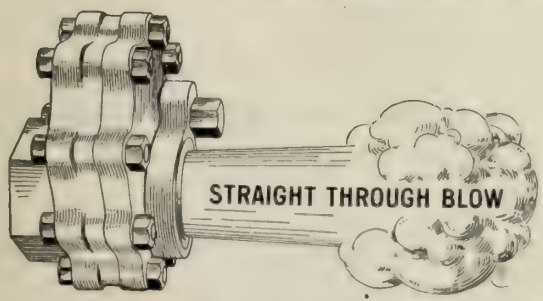
1st order	March 1908	3 furnaces, 645 h.p.
2nd "	Feb. 1910	1 furnace, 215 h.p.
3rd "	June 1913	4 furnaces, 600 h.p.
3 contracts—in 5 years:		8 furnaces, 1460 h.p.

REPEAT ORDERS are the best evidence of merit!

For printed matter address:

MURPHY IRON WORKS, DETROIT, MICH. BUFFALO, N. Y.

EVERLASTING
BLOW-OFF VALVES



IT NEVER LEAKS!
WRITE FOR PRICES

200,000 IN USE

Does your Boiler leak, Mr. Engineer?
How often do you blow it?
The "EVERLASTING" is the only perfect blow off valve on the market.
No stuffing box—requires no packing—is self-cleaning, and has a self-grinding seat—nothing to get out of order—What's the answer?

RELIABILITY—SIMPLICITY.

SOLD AND MANUFACTURED UNDER CANADIAN PATENTS BY

Engineering Specialties Company, 1080 King St., West, TORONTO
LIMITED

AGENTS

MONTREAL, QUE. H. L. Peiler & Co.
ST. JOHN, N.B. The A. R. Williams Mach. Co.
WINNIPEG, MAN. The A. R. Williams Mach. Co.
CALGARY, ALTA. P. D. McLaren Limited
VANCOUVER, B.C. Taylor-Forbes Company, Limited

5 Big Features in one tool—

OSTER

Pipe Threading Tool
No. 104½

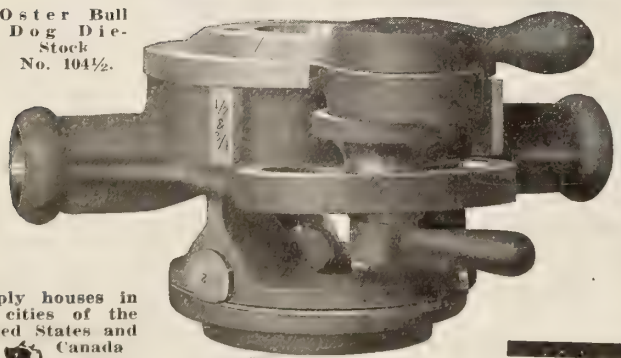
MANY die-stocks have **one** good point. Here is a die-stock with **5** big points as well as a threading capacity of eight sizes of pipe.

is one of the results of our twenty years' experience in the manufacture of pipe-threading tools. We have given this tool a splendid range of sizes, eight in all from ¼" to 2" besides the following Five Big Oster Features: (1) Self-locking dies controlled by a single lever-movement; (2) Self-locking guides—the famous lever-operated "Bull Dog Grip;" (3) No resetting after each cut; (4) No running back over newly cut threads; (5) No loose bushings to lose—No small parts to break.

Read in our illustrated booklet *"The Bull Dog Tale"* about the complete Bull Dog Line. Free to you by return mail.

The Oster Mfg. Co.
2099 East 61st Street,
Cleveland, Ohio

Oster Bull Dog Die-Stock No. 104½.



Supply houses in 251 cities of the United States and Canada carry Oster Bull Dog Tools.

Kindly send me by return mail *"The Bull Dog Tale."*

NAME .....

ADDRESS .....

CITY .....

STATE ..... (2699)

DURABLA

DURABLA Etched on Every Glass

Metallic Gauge Glass for Safety

Unaffected by sudden changes of temperature

Always Clear!

DURABLA MANUFACTURING CO.
114-118 Liberty Street, New York

CANADIAN SALES AGENTS
CANADIAN FAIRBANKS-MORSE CO., LIMITED
Montreal, Ottawa, Calgary, St. John, Toronto, Saskatoon, Quebec, Winnipeg, Vancouver

Second Hand
BOILERS

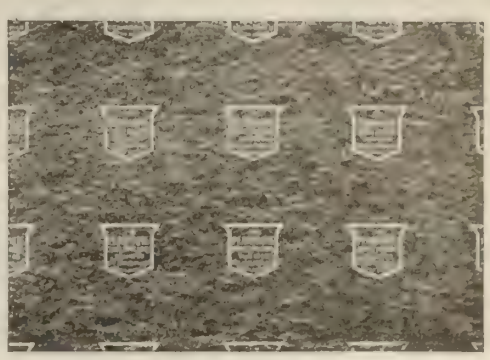
We have a few exceptionally good Second-Hand Horizontal Tubular Boilers in stock which we are offering at very attractive prices.

Some of them are practically new and all of them are in good order, and if you want a second-hand boiler, this is a particularly good opportunity for you.

Shall we send you particulars?

William Hamilton Co.
PETERBOROUGH, ONT.

Stands Most Severe Tests and Meets all Packing Conditions



The fact that J-M Permanite Sheet Packing was subjected to severe tests (tests lasting three months) with superheated steam, saturated steam, water and air pressure, intense heat, vibration, etc., and then found to be in perfect condition and continued in service, proves that J-M Permanite possesses the most desirable features of any packing, viz., efficiency, durability and economy.

J-M PERMANITE PACKING

keeps joints absolutely tight and requires no following up. Works equally well on high or low pressure steam, water and Ammonia Lines, acids, alkali and sugar solutions. It will not harden, burn, blow out or squeeze out, because made of asbestos, an indestructible mineral that is impervious to the action of acids, alkalies, ammonia, oils, etc.

Ask our nearest branch for a large sample of J-M Permanite and make your own test. We'll also send you our Booklet.

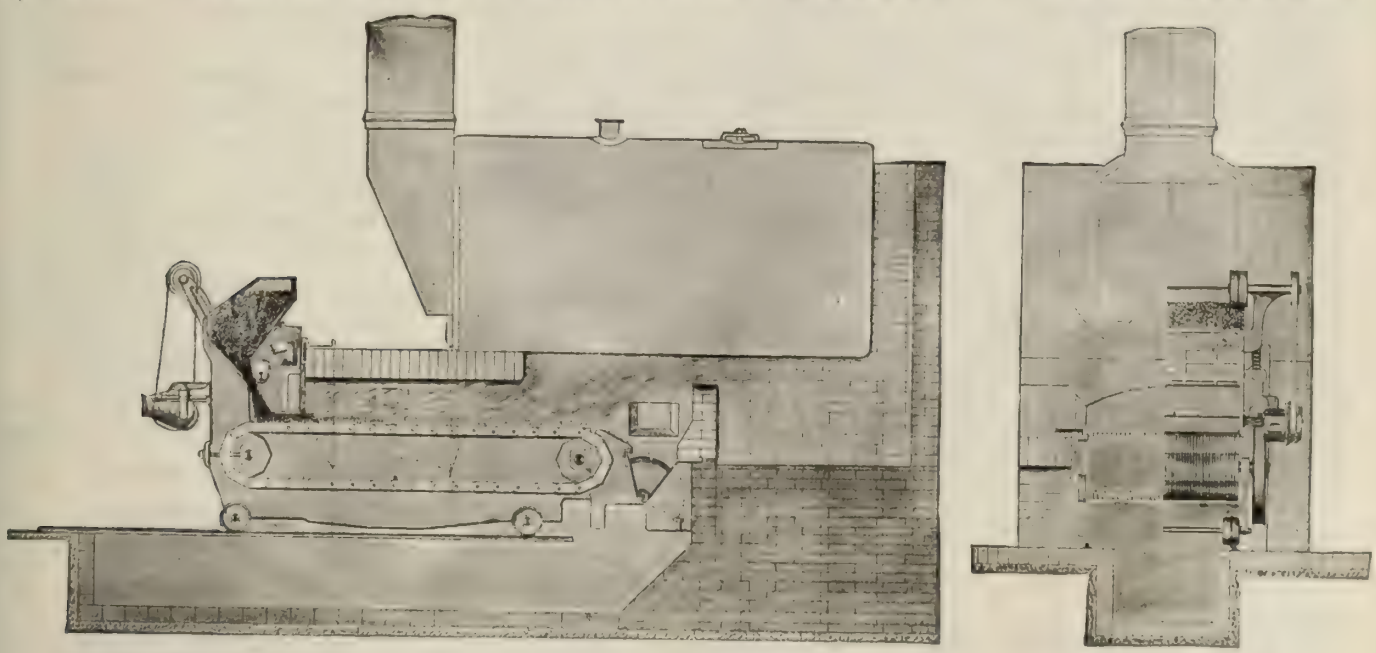
THE CANADIAN H. W. JOHNS-MANVILLE CO., LIMITED

Manufacturers of Asbestos and Magnesia Products — ASBESTOS TRADE MARK — Asbestos Roofings, Packings, Electrical Supplies, Etc.

Toronto Montreal Winnipeg Vancouver

1433

The Chain Grate Machine-Stoker That Matters



— BENNIS-PATENT CHAIN GRATE STOKER APPLIED TO HORIZONTAL RETURN TUBE BOILER —

There is one machine-stoker for CHEAP steam-raising with water-tube boilers. It is the BENNIS Chain Grate, with the new strong **Bennis** patent link, which does not burn out, and keeps clear, strong fires with low-grade, small fuels.

Write for "Machine Stokers That Pay" pamphlets to

G. H. TOD, 213 MANNING CHAMBERS QUEEN STREET WEST **TORONTO**

Winnipeg, 601 Union Bank Building

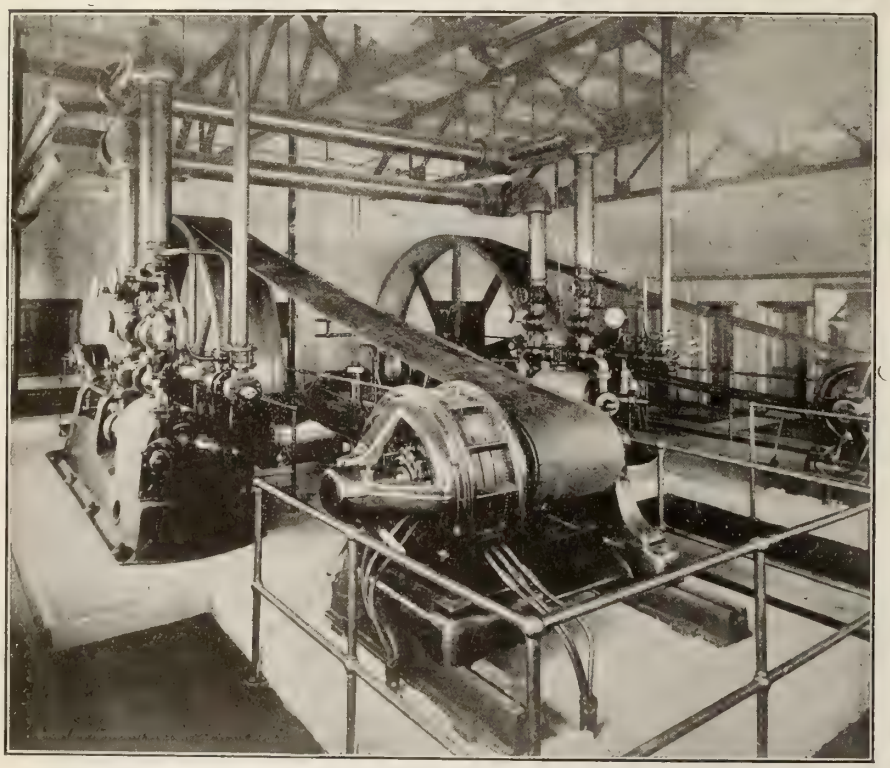
The advertiser would like to know where you saw his advertisement—tell him.

"THE LINDE"

REFRIGERATING and ICE-MAKING MACHINERY

CORK INSULATION

Over 8,000 Machines in use. Established and Manufacturing in Canada for 16 years.



Two 100-ton "Linde" Belt Drivers, Double Acting, Horizontal Ammonia Compressors Manufactured and Installed by us in Canada.

Recent Orders:—

McDONAGH & SHEA, Winnipeg, Man.

O. LECLAIR, Ottawa.

MUNICIPAL HOSPITALS, Winnipeg, Man.

CANADIAN NATIONAL EXHIBITION, Toronto, Ont.

C.P.R. VANCOUVER HOTEL, Vancouver, B.C.

C.P.R. CALGARY HOTEL, Calgary, Alta.

SWIFT CANADIAN CO., Montreal, Que. (2nd plant).

McGILL UNIVERSITY, Montreal, Que.

OTTAWA UNIVERSITY, Ottawa.

MR. J. A. PATRICK, Westminster Hockey Arena.

O. LESAGE, Montreal, Que.

AND MANY OTHERS.

The Linde Canadian Refrigeration Co.,

Limited

37 ST. PETER STREET, MONTREAL

Branch Offices—Toronto, 28 Front St. East; Winnipeg, 909½ Main St.; Vancouver, 42 Inns of Court Building; Edmonton, Walker & Barnes, 562 Second Street; Calgary, General Supplies, Limited, 1233 2nd St. East.

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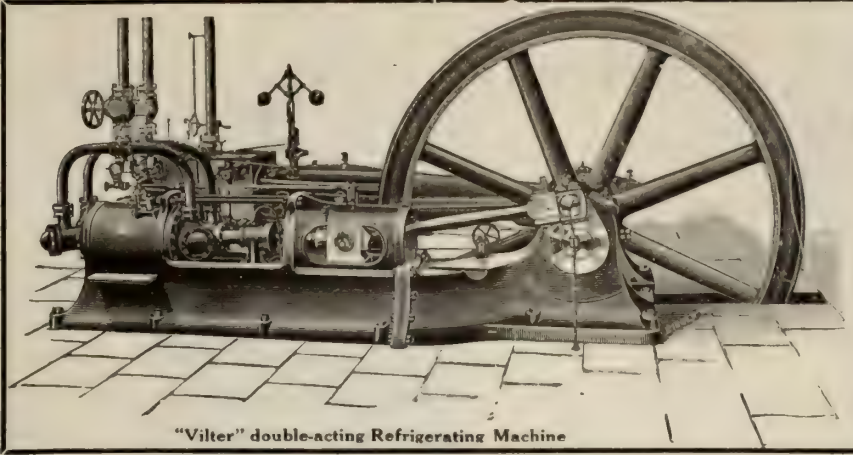

"Vilter" double-acting Refrigerating Machine

Established 1867

The VILTER MFG. CO.

242 Becher St. Milwaukee, Wis.

BUILDERS OF HIGH-GRADE

CORLISS ENGINES
ICE AND REFRIGERATING MACHINERY

any size and for any purpose, complete line Ammonia Fittings, Condensers, Brine Coolers, etc.

Write for Catalogue and full Particulars

The
LINDE BRITISH
Refrigeration Co. Limited

¶ Numerous fully authenticated laboratory tests organized from time to time in America and Europe, have invariably served to demonstrate in an unanswerable manner, the very remarkable degree of mechanical efficiency to which our products have been brought. *The history of mechanical refrigeration is our history.*

Head Office: LONDON, ENG.

BIRMINGHAM	GLASGOW	JOHANNESBURG, S.A.
BRISTOL	BOMBAY	SYDNEY, N.S.W.
LIVERPOOL	CALCUTTA	PORT NAPIER, N.Z.

CANADIAN OFFICES
CORISTINE BLDG
MONTREAL

Self-Lubricating

In Cans
6, 12, 25 and 50 lbs.

SAFETY PLASTIC
METALLIC PACKING

FOR STEAM, WATER, AIR, GAS, ETC.
LASTS FOR YEARS AND NEVER WEARS THE PISTON ROD.

Guaranteed to stand steam temperature up to 550 degrees Fahr.
Guaranteed to stand hydraulic pressure to 5,000 pounds per square inch.
Packing furnished in bulk and in thin Cotton Tubes, sizes 3-16 to 1½ inch, 36 inches long, or in special lengths to fit your stuffing boxes.
Empty Cotton Tubing in assorted sizes FREE OF CHARGE with orders for the packing in bulk form.
The tubes are easily filled and they save you the expense of carrying a large stock of packings in different sizes.

Send for FREE SAMPLE and particulars.

Manufactured only by

STEEL MILL PACKING CO., WINDSOR, ONT.

Practically Frictionless

Any Quantity sent on APPROVAL

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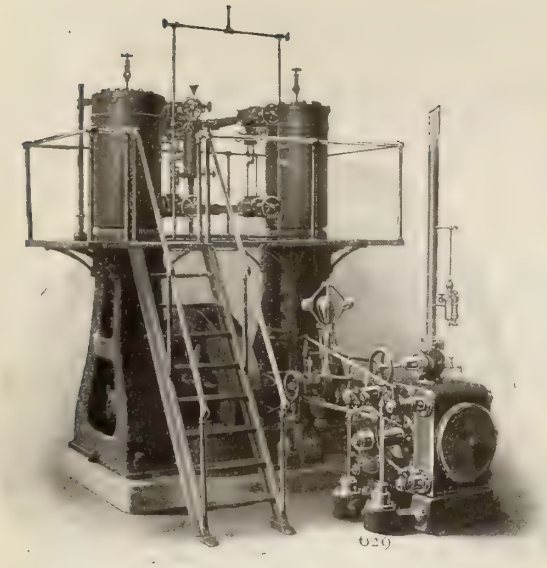


Get Ready for Next Season

If you are thinking of a new Plant for next season, or contemplate additions to your present equipment, don't wait—place your order early.

We predict an unusual demand for Ice-Making and Refrigerating Plants during the coming season—facilities will be taxed to the utmost, and late-comers will suffer by reason of delay.

Get an early start, but be sure you start right. First think of YORK, then ask us to tell you what we have done for others, and what we can do for you.

Our complete line enables us to give you an unbiased opinion as to the kind of Plant best suited to meet your local conditions. No fancy record stunts, under ideal conditions; for advertising purposes, but the steady output right up to capacity, day after day, week after week, all through the season, that delights the owner and helps to swell his bank account.

That's the kind of Plant **you** want—YORK Plants are that kind.
Remember—start early—start right—think of YORK—we will do the rest, if you give us a chance.

YORK MANUFACTURING COMPANY

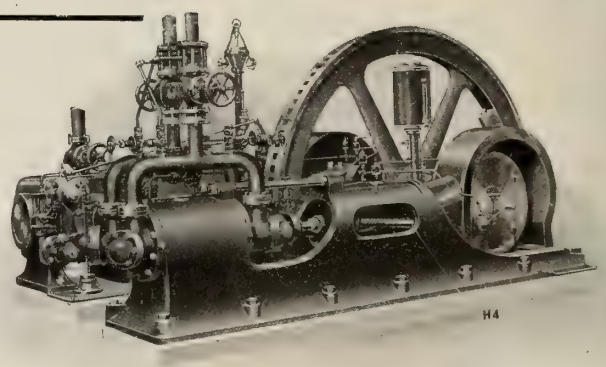
Largest Manufacturers of Ice Making and Refrigerating Machinery in the World

Main Office and Works: YORK, Pa., U.S.A.

Represented in the Dominion by CANADIAN ICE MACHINE COMPANY

TORONTO, 163-167 Yonge Street **WINNIPEG, P.O. Box 336**

FRICK



Refrigerating and Ice-Making Machinery and Equipment

is acknowledged the world over to have attained the highest degree of efficiency. For thirty-three years FRICK Machines have successfully endured the wear of exhaustive tests and proven all guarantees made.

It will pay YOU to KNOW US.

The FRICK is the only machine of which it can be said "There is no better machine built." The FRICK is durable—efficient and will last a lifetime.

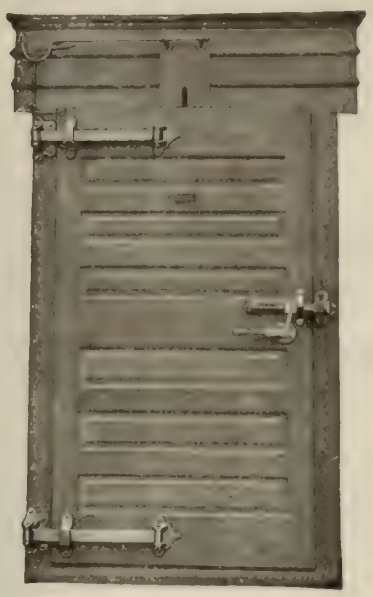
We build all types of Refrigerating Machines—Vertical Single-acting, Horizontal Double-acting and Absorption.

WRITE FOR CATALOGUE TO

FRICK COMPANY, - Waynesboro, Pa., U.S.A.

KEITHS LTD., TORONTO NEW YORK CHICAGO PITTSBURGH CLEVELAND
ST. LOUIS DALLAS ATLANTA BALTIMORE BOSTON
United Iron Works: Oakland and Los Angeles Cal., and Seattle, Wash.

J. V. Jamison, President. T. B. South, Vice-President. J. V. Jamison, Jr., Treasurer.



The Correct estimated value of

A Refrigerator Door and Window

—is service.

1st. Efficiency
2nd. Strength and Durability.

Jones Cold Store Door Co.

Hagerstown, Maryland.

products combine and recommend to the trained and untrained eye, unexaggerated ability to perform its work and to stand up to its place. The construction object is in defiance to the

Slam Bang Laborers "Disable Me If You Can"

HINGES AND FASTENERS weigh 60 lbs. to the set. The Doors and Windows work as easy as the front Door on your dwelling.

They will not leak.

Refrigerator Doors and Frame and Windows mean shipped complete ready to set in the opening.

We guarantee our "AD" statements.

We believe a big part of our success is due to pleasing our Patrons.

We are the sole manufacturers of the "NOEQUAL" DOOR with round jambs, so popular with the packing trade.

Our Revolving Ice Cream Door is a success for its purposes.

Our Ice Doors and Chutes do all that is required.

Jones Cold Store Door Co.

HAGERSTOWN, MD. U. S. A.

Arctic Electrically Driven

Ice plants are producing pure, crystal ice in cans, at a decreased cost for power and labor, and making a finer quality ice than the distilled water product.

This result is accomplished by installing our

Raw Water Ice Making Equipment

using the Arctic-Pownall System.

Any cheap motive power, such as water power, oil or gas engine, or electricity may be used.

Full particulars and printed matter will be mailed you — simply write us saying you are interested.

"We do it Right."

THE ARCTIC ICE MACHINE CO.

CANTON, OHIO, U.S.A.

You're Losing Money

If you are not using the best insulation in your refrigeration plant.

You Can Stop That Loss At Once By Using Our

Corkboard Insulation

It is made of pure cork, and is recognized as the best insulation for cold storage and refrigerating purposes.

It is the only cork insulation that is made in Canada.

Write for full particulars.

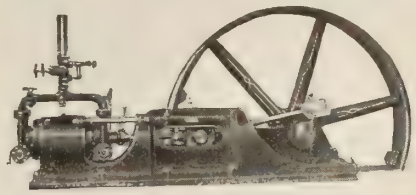
Robinson Bros. Cork Co., LIMITED

HEAD OFFICE—803 LUMSDEN BLDG. TORONTO

FACTORY—
PORT COLBORNE, ONTARIO

5 REASONS WHY

The Huetteman & Cramer Co's Safety Compressor should be your choice!



1st. Because it is safest.
2nd. Because it is most reliable—Serviceable.
3rd. Because its working parts are most accessible.
4th. Because its design and construction make it stand the strains of strenuous service.
5th. Because it is most economical in consumption of power, ammonia and lubrication.

Get our new Catalogue—3 and Booklet "Cold Facts"—it gives interesting facts and figures
Write over to

The Huetteman & Cramer Co.

Simple—Servicable—"Safety" Ammonia Compressors.

DETROIT - MICH.

Save Fuel and Increase Profit

A few engineers find this a difficult problem. They are not acquainted with

The "OTIS"

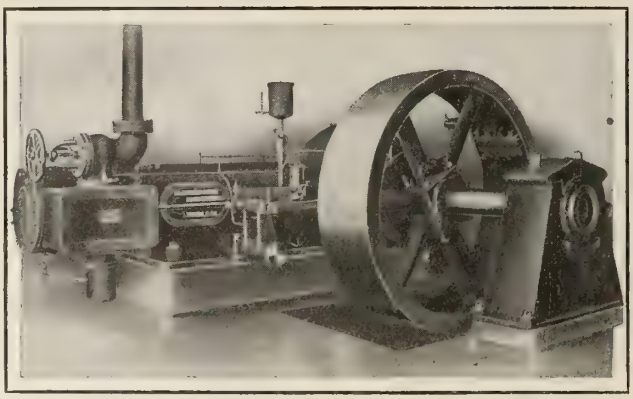
TUBULAR FEED WATER HEATER, OIL SEPARATOR AND PURIFIER

The exhaust steam when harnessed and passed through this Heater will heat the Feed Water to a boiling point before it enters the boiler. This effects an enormous yearly saving in fuel.

Write for descriptive catalog and prices.

The STEWART HEATER CO.

189 Norfolk Ave., Buffalo, N.Y., U.S.A.



Side Crank Leonard Automatic Engines

Particularly adapted for Direct Dynamo Connection and Electric Light Service. Made in Simple and Compound Units up to 500 Horse Power. For High Economy and Close Regulation this engine is unexcelled.

We also make High and Slow Speed Corliss Engines for Heavy Duty Service. Our "Tangye" Engine is very well and favorably known throughout Canada for Sawmill Work.

MADE BY

E. LEONARD & SONS, LONDON, ONTARIO

MANUFACTURERS OF

High and Slow Speed Engines of all kinds, Boilers, Heaters, Pumps, etc., etc., and complete Steam Plants.

WAREHOUSES AND AGENCIES AT

MONTREAL, ST. JOHN, N. B., CALGARY, WINNIPEG, VANCOUVER

The advertiser would like to know where you saw his advertisement—tell him.

WOODWORKING MACHINERY

High Speed, Heavy Duty and Grit and Dust Make this Class of Machinery Very Trying on Babbitt Metals

We Have Many Testimonials, Besides Those Given Below Showing that **Magnolia Metal** is Ideal for that Service.

POUK MANUFACTURING COMPANY,
Chicago, Ill., Oct. 13th, 1910.

Gentlemen:—
I am using Magnolia for years for high speed Machinery—such as shaper bearings, 5,700 R.P.M. Have tried several other babbitts, but obtained best results with Magnolia.
If it comes to lining heavy loose pulleys and bearings for heavy shafts it is the one that lasts.
Respectfully,
F. A. SAWITZKE, Eng.

J. J. McGILLIVRAY,
Sash, Doors and Mouldings,
Black River Falls, Wis., March 31st, 1911.

Gentlemen:—
I desire to state that all the bearings of this Sash & Door Factory are lined with Magnolia. One planer has not been rebabbitted in **Fifteen years** and is in good condition to-day.
I always make it a point not to overheat the babbitt and stir thoroughly before pouring.
J. C. JOHNSON, Supt.

MARSHFIELD STAVE COMPANY,
Marshfield, Wis., April 4th, 1911.

Gentlemen:—
All bearings in this Factory are lined with Magnolia Metal. We have found it superior to all other metals for our plant: one planer running 3,000 R.P.M. or more has not been rebabbitted for several years.
Yours truly,
MARSHFIELD STAVE COMPANY,
Frank Mertle.

SOLD BY LEADING DEALERS EVERYWHERE OR BY

MAGNOLIA METAL CO.

OFFICE AND FACTORY:

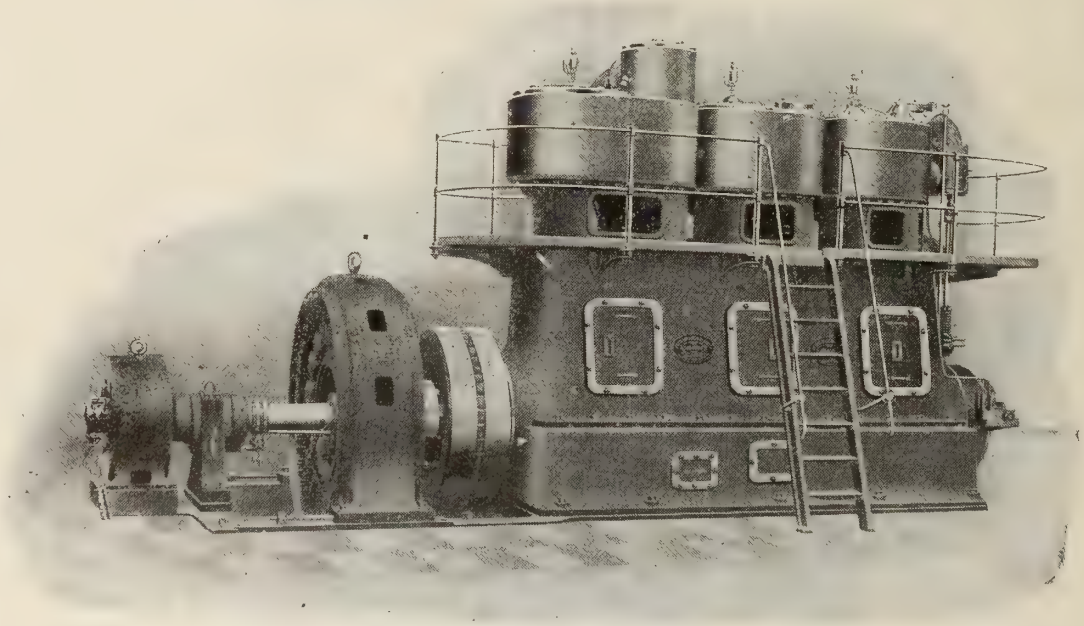
225 Ambroise St., - - MONTREAL

The "Browett-Lindley"

Quick Revolution, Forced Lubrication, Double Acting Steam Engines

Simple ***Efficient*** ***Economical***

These engines have established a high reputation in electric light and tramway plants, collieries, cotton and paper mills, steel and iron works, etc., and are made in five different styles to suit steam pressure and working conditions.



Three-crank, Triple Expansion, "Browett-Lindley" Engine driving 500 K.W. Generator.

Two Installations, 750 Brake Horse Power each; 350 Revolutions; Montreal Water Works.

Sole Agents for Canada:

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO., Limited

Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

Works: Seigneurs & Williams Streets, MONTREAL.

W. H. ALLEN, SON & COMPANY

LIMITED

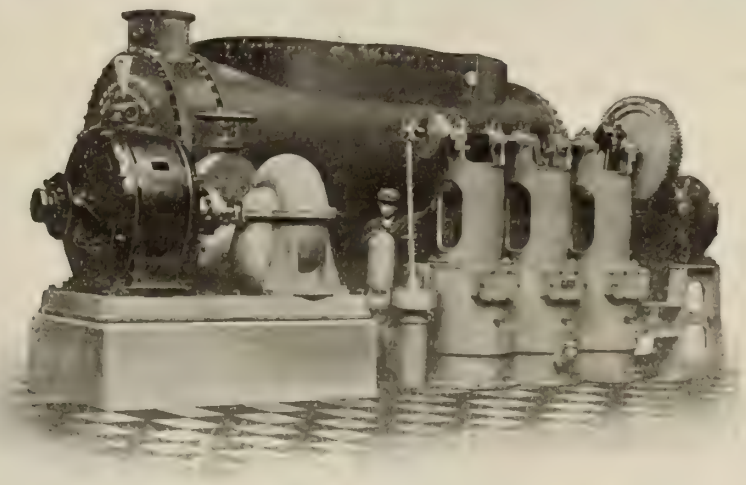
QUEEN'S ENGINEERING WORKS, BEDFORD, England

ENGINEERS AND BUILDERS OF

Steam, Hydraulic and D.C. Electric Machinery

"CONQUEROR" CONDENSING MACHINERY

HIGH EFFICIENCY HIGH VACUUM



66 thousand lbs. of steam per hour, 28 inch Vacuum. Centrifugal Circulating Pump driven direct by Motor, a separate Motor driving through gearing an "Allen Edwards" Three-Throw Air Pump and Condensed Water Lifting Pump.

Small quantity of circulating water.

Lower power required for driving pumps.

For prices and full particulars, apply to head office at

BEDFORD, England

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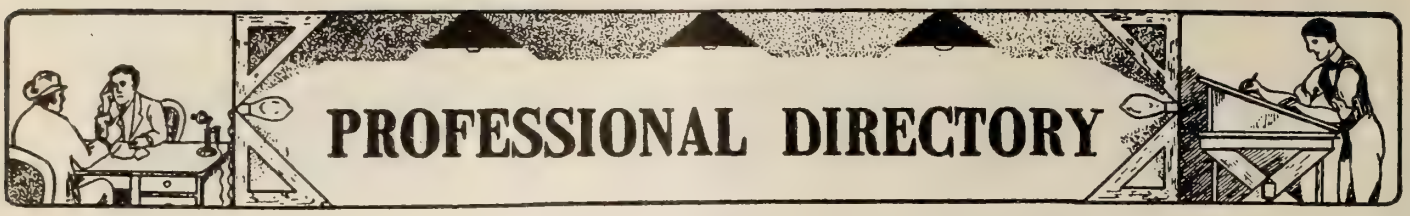

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Cable Address, "Walfran, Montreal"—W. U. Code
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Industrial and Consulting Engineers, Etc.
Power House and Factory Design, Reinforced Concrete.
1011 Electric Railway Chambers Winnipeg

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Mechanical and Hydraulic Engineer
Green Fuel Economizer
Mechanical Draft Apparatus
427 Coristine Bldg., MONTREAL
Write for Catalogue P.

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(of Invention)
Van Hallen & O'Neail.
Offices, Room B, 103 Farmer Bldg., Winnipeg, Man.

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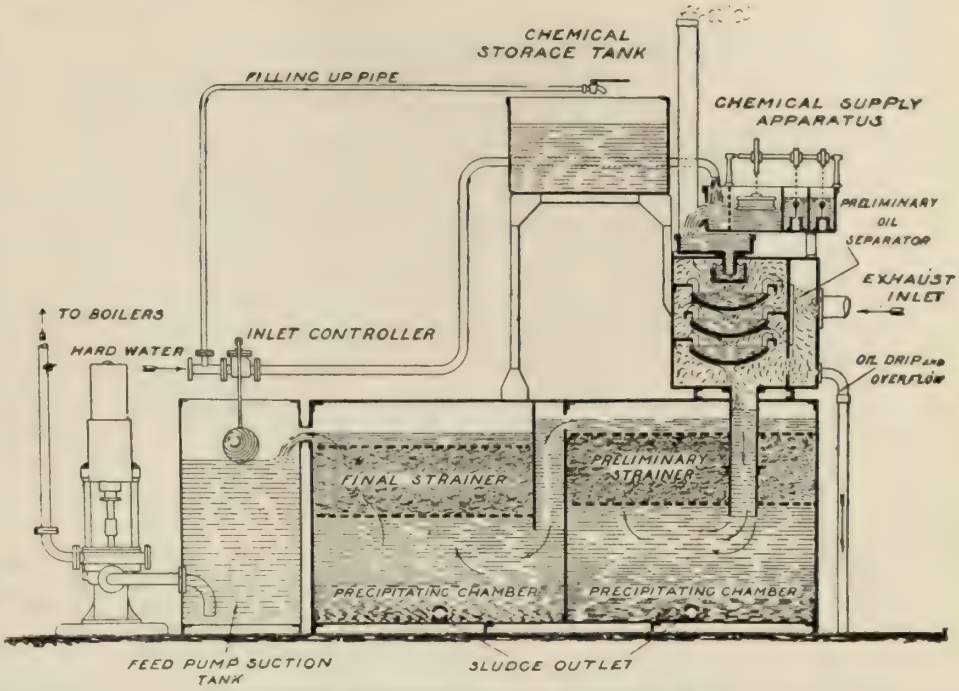
With this plant the temporary hardness is removed without the use of chemicals, the permanent hardness by the addition of sodium carbonate in accurate proportion to the amount of water passing.

The oil and finely suspended matter is completely removed by the Paterson system of coagulation and filteration.



HEATER, SOFTENER AND OIL ELIMINATOR.

Manufacturers: PATERSON ENGINEERING CO., London, Eng.

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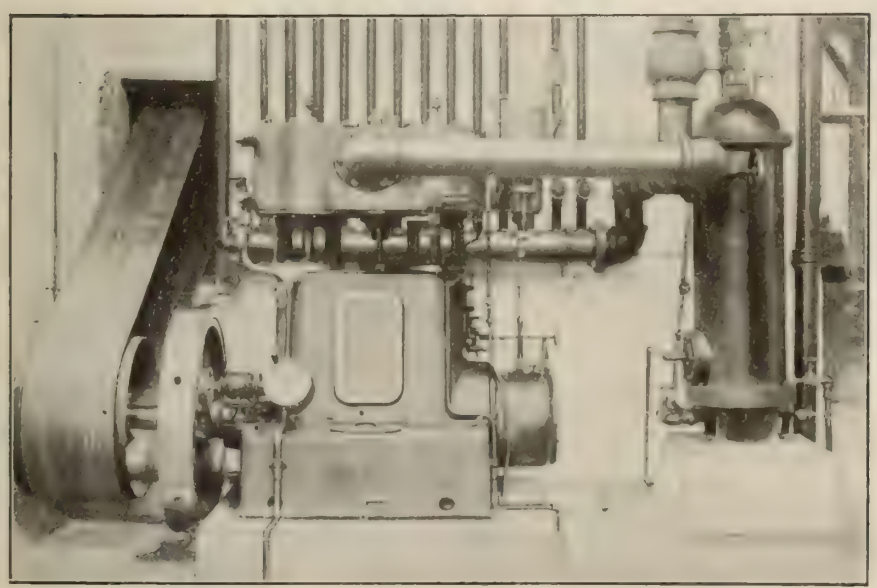

TWO CYLINDER COMPOUND ENGINE FOR BELT DRIVE IN A MONTREAL FACTORY.

Over 150 installations in Canada.

Among our customers we number the municipalities of

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SCIENTIFIC FEED-WATER TREATMENT

INDIVIDUAL TREATMENT OF BOILER FEED WATERS

IF it were possible to treat boiler feed supplies successfully by preparing *one formula* and furnishing that one preparation in all cases, regardless of the conditions or nature of the water, that would be a much simpler method than the one we pursue, and would save us the thousands of dollars spent annually to maintain our Laboratories, with their costly apparatus and appliances, and high salaried chemists.

But our business, which embraces thousands of satisfied customers, could not have been built up in that way. A *one formula* treatment might have given excellent results at one plant, but there would have been a hundred others where it would have been a complete failure.

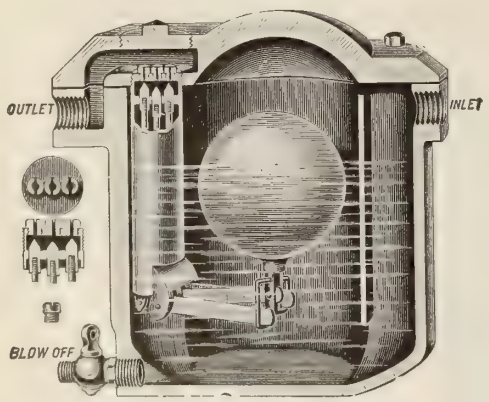
The success of Dearborn methods lies in the fact that they are common sense scientific methods. No two waters are alike in mineral content. Neither are the mechanical conditions always alike, even in plants using water from the same source of supply.

We take these differences into consideration, familiarize ourselves with the operating conditions at each plant for which treatment is furnished, analyze the water, and then prepare a special formula for treatment to meet the exact requirements.

Let us analyze your boiler water (send us gallon sample for this purpose) and advise regarding treatment.

Dearborn Chemical Company of Canada, Limited
TORONTO, CANADA

Office, 705 C.P.R. Building. **Factory, 1220-30 Dundas Street.**



Wright
"Emergency" High Pressure Continual Flow Steam Trap

THREE VALVES

GREAT CAPACITY

Keeps the steam line automatically and continually drained of accumulating condensation.
Shipped subject to trial and return if results are not satisfactory.
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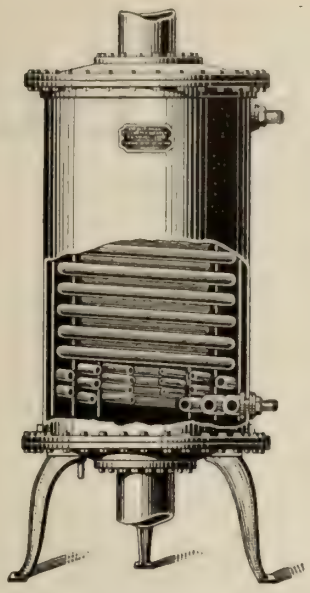

MUCH of the trouble of keeping up steam, much of the fuel now wasted because exhaust steam escapes, much of the wear and tear on boilers, can be saved by the use of

NATIONAL
FEED WATER HEATERS

The National Closed Heater, shown here, is both safe and durable, for the shell is not under pressure — it never corrodes, for it is not in contact with exhaust steam; the coils are guaranteed to stand 600 pounds per square inch and the feed water has no action on copper and brass.

No back pressure, for steam space is ample.

Ask for— Catalog No. 1, Closed Heaters.
Catalog No. 2, Open Heaters.

149 Broadway
New York

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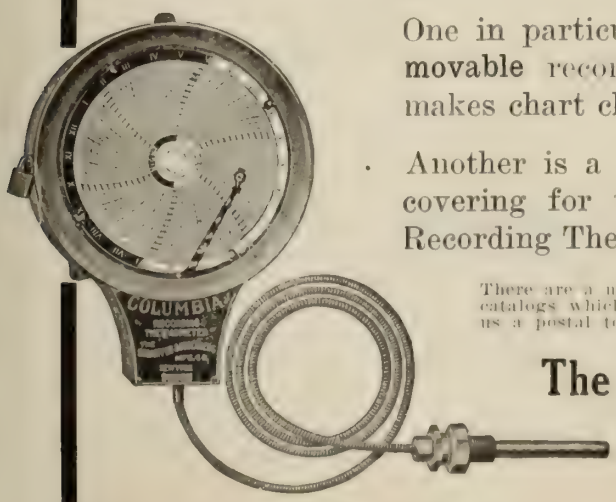
46-49

THE NATIONAL PIPE BENDING COMPANY
91 Lloyd Street, New Haven, Conn.
Makers of Pipe Coils and Bends of Every Description—for All Purposes—Copper, Brass, Iron.

Of Vital Interest To Every Engineer

are the many new and important improvements effected in "Columbia" Recording Gauges and Thermometers.



One in particular is a patented **removable** recording pen arm which makes chart changing easy.

Another is a "bran-new" idea in insulated covering for the steel connecting tubing of "Columbia" Recording Thermometers.

There are a number of other interesting points—all told in two handsome catalogs which are yours at any time you ask for them. Why not drop us a postal to-day? Just say—Send Catalogs W100 and 28.

The Schaeffer & Budenberg Mfg. Co.
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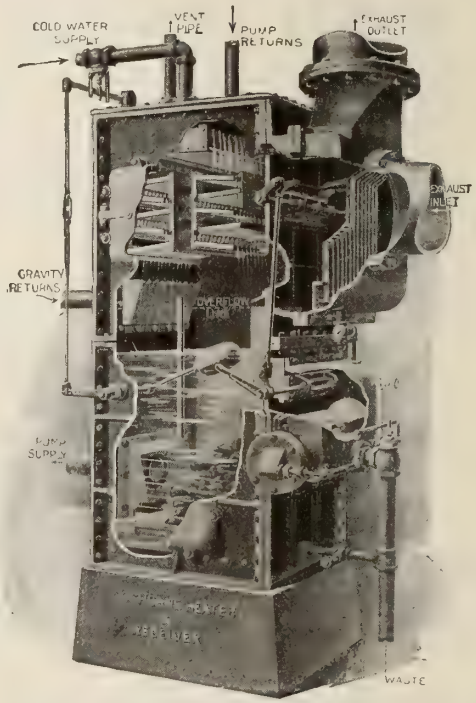
COCHRANE FEED WATER

HEATERS AND RECEIVERS

FOR USE IN CONNECTION WITH EXHAUST STEAM HEATING AND DRYING SYSTEMS



Cochrane Steam Stack and Cut-Out Valve Heater and Receiver.

THE most striking example of the profitable utilization of exhaust steam is to be found in those plants where there is a surplus of exhaust above what is required for heating the boiler feed water, which can be applied to heating buildings, drying materials, the operation of low-pressure turbines, supplying absorption ice machines, use in cooking kettles, calendering rolls, etc., etc. Before the steam is utilized in this manner, it should be purified of oil, so that the returns, or condensate, may be brought back to the heater and used over again as boiler feed. The heater thus serves as a receiver or return tank for the condensate, at the same time admitting automatically the amount of raw water required to make up the whole boiler feed supply.

See Catalogue No. 500

It describes Cochrane Heaters and their use in steam power plants and will interest you.

CANADIAN ALLIS-CHALMERS, LIMITED

Manufacturers of Air Compressors, Boilers, Cement Making Machinery, Concrete Mixers, Flour Mill Machinery, Gas Engines, Hoisting Engines, Hydraulic Machinery, Locomotives, Ornamental Metal Work, Rock Crushers, Rock Drills, Saw Mill Machinery, Steam Pumps, Steam Specialties, Steam Shovels, Steam Turbines, Structural Steel, Transmission Machinery, Turbine Pumps, Water Wheels.

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Why The Advertiser Succeeds.

¶ Why is it that during the last few months, when money was admittedly tight, the manufacturers who advertised the most felt the pinch the least?

¶ And how is it that now, when the circulation of money is less restricted, the manufacturers who felt the pinch the most will be the last to experience relaxation and relief?

¶ The same wisdom and foresight which prompts a manufacturer to advertise will naturally guide him in forming his whole selling and general business policy, and, like a good general, he is prepared for every contingency and emergency.

¶ The fact that the successful business man is an advertiser is usually incidental. He is an advertiser because he is wise and possessed of good sound business sense and an analytical mind. At some time or other he came to the conclusion that advertising could be made one of the mightiest factors of his business organization, and having arrived at this conclusion, he just naturally went to it and advertised.

¶ He had faith in his product, and his own faith manifested in a public way, inspired confidence in the minds of his prospective customers. His name and his manufactured product became synonymous with good service and satisfying quality. The public became acquainted with the merits of his line and familiar with its outstanding features.

¶ Consequently, when conditions were normal, he secured a liberal share of business and received first consideration when purchases were made.

¶ When money tightened and business was curtailed, he continued to get the lion's share of what was going. When purchases were carefully considered the advertised line received first attention and usually secured the order.

¶ And now that the financial tide is coming back, the advertiser is getting the biggest slice of the business melon, simply because during those cloudy days of curtailment, his advertising message had been studied and absorbed at a time when the public mind was most receptive.

¶ It pays to advertise if your line is good, and it pays to buy advertised lines, because they are invariably satisfactory. The general public have long been educated to believe that advertised goods are best. Can't you see that you are laboring, not only under a handicap, but under a cloud, if your product is not advertised? Publicity dispels the cloud of suspicion and removes the handicap.

¶ You'd better hop on to the band wagon right away. Hopping on now, when the prospects for big business are so bright, will be not only timely, but extremely profitable.

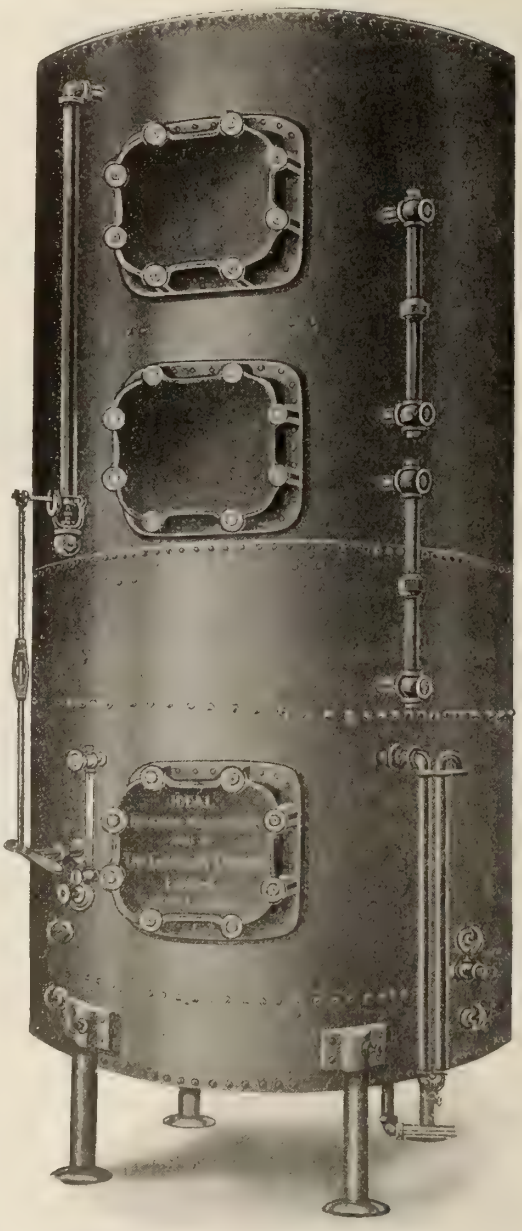
Rate Card and full information gladly furnished.

THE POWER HOUSE

A Monthly Publication Devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power

143 University Ave., TORONTO

The "IDEAL" Feed Water Heater, Purifier and Oil Extractor Pays for itself quickly



This Heater effectively extracts all oil and grease from the exhaust steam, and removes all carbonate scale-forming matter from the feed water.

It will deliver the feed water to boiler at nearly boiling temperature.

The construction of Heater is such that all parts are easily accessible.

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Light, Heat and Power Equipment, Wellesley Hospital, Toronto

Staff Article

The following article will furnish the reader with an illustration of the progress that is being made in modern hospital equipment and will serve to show the advantages to be derived by having an independent light, heat and power plant where reliability and continuous service are the chief factors to be considered.

THE Wellesley Hospital, Toronto, opened by H.R.H. The Duke of Connaught, Governor General of Canada, on August 27th, 1912, occupies a site covering about three acres on what was known as the "Homewood" estate, facing on Wellesley St. It is essentially a private institution, devoted exclusively to the care of pay patients, and is the largest of its kind in Toronto. The building was designed by Stevens & Lee, architects, Toronto, and the layout and equipment is of the most modern description.

Accommodation has been provided for 72 patients who occupy private and semi-private rooms, the latter containing two or three beds. A number of the private rooms have bathrooms attached, the others having a hot and cold water service. A roof garden and several private balconies have been provided for the use of patients. There are two modernly equipped operating rooms with the necessary sterilizing rooms, etc., also pathological and clinical laboratories and an X-Ray department. A building is being erected on the north-east corner of the property which will be used as a nurses' home. The hospital is governed by a board of directors, of which Sir Wm Mulock is President. Miss Elizabeth G. Flaws is the Superintendent.

Utilities Building.

A building located on the north end of the property and separated from the hospital contains the power generating plant, boiler room, laundry, and refrigerating plant. This building is isolated to avoid possible noise or other disturbances affecting the patients. A tunnel connects the two buildings through which all the piping, etc., is taken. It can also be used by the staff. The tunnel opens out into the boiler room, the floor of which is below the ground level on account of the height of the boilers. The laundry and power house are on the ground level. James G. Russell is engineer in charge of the plant.

The plumbing and heating contract was carried out by W. J. MacGuire & Co., Toronto, and the electric lighting contract by Rice, Green & Co., Ltd., Toronto. Williams & Cole, Consulting Engineers, Toronto, were responsible for the layout of the mechanical equipment which was installed under their supervision.

Boiler Equipment.

The boiler room contains two heavy duty "Fitzgibbon" boilers furnished by the John Inglis Co., Toronto. They are 80 h.p. each, have 800 sq. feet heating surface and are equipped with shaking

FRONT ENTRANCE AND ADMINISTRATION BUILDING, WELLESLEY HOSPITAL.

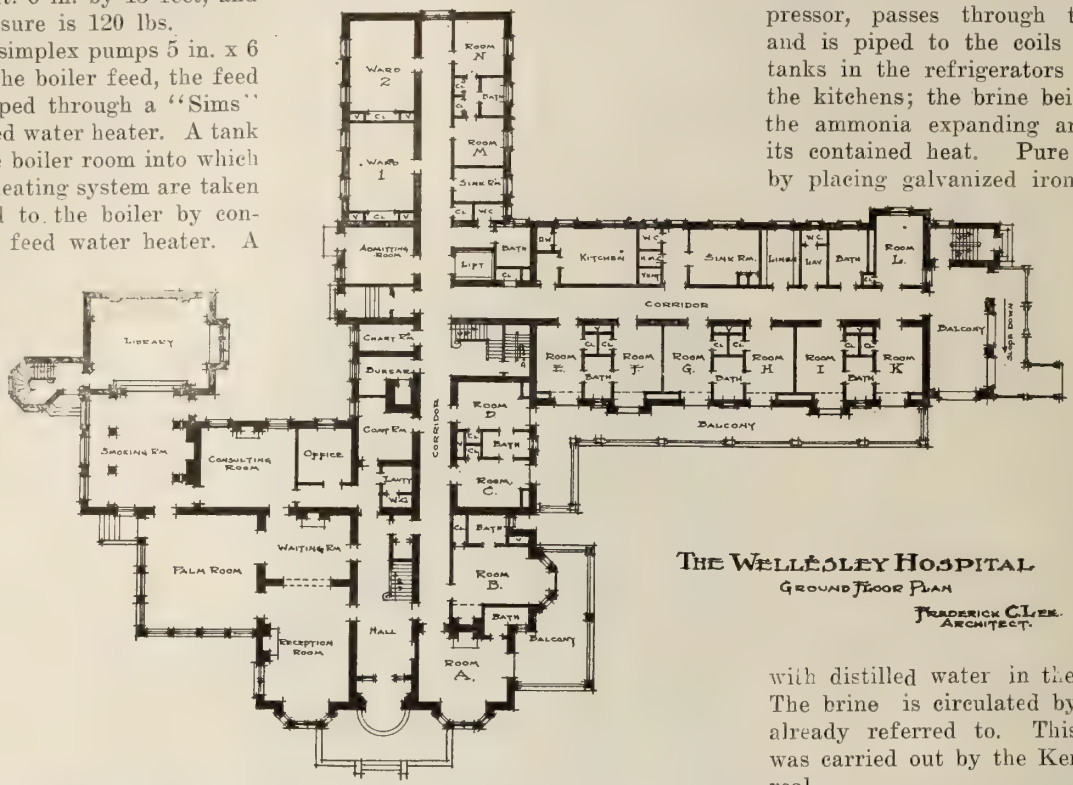
grates. This design of boiler is a combination of the horizontal and vertical types, is self contained and requires no brick setting. Each boiler occupies a floor space of 5 ft. 6 in. by 13 feet, and the working pressure is 120 lbs.

Two Burnham simplex pumps 5 in. x 6 in. take care of the boiler feed, the feed water being pumped through a "Sims" exhaust steam feed water heater. A tank is installed in the boiler room into which drains from the heating system are taken and are returned to the boiler by connection with the feed water heater. A damper regulator for controlling the draft is installed and was supplied by the Spencer Damper Regulator Co., Salem, Mass. A "Mason" reducing valve is fitted in the steam line which supplies the kitchens and operating room sterilizers with live steam. A reducing valve is also fitted in the steam line to the laundry. A Bundy steam trap is installed in connection with the separator which is fitted in the steam pipe to the engines, and an "Anderson" trap is installed in connection with an oil separator on the exhaust line. The steam pipes in the boiler room are of mild steel and are equipped with "Nelson" valves. The piping was installed by the W. J. McGuire Co., Toronto. A Columbia pressure recording gauge is located in the engineer's office, and was supplied by the Schaefer & Budenberg Co., New York. This apparatus provides a daily record on a chart of the boiler pressure, in addition to the pressure gauges in the engine room.

Generating Equipment.

The engine room contains two Robb-Armstrong 10 x 10 in. and 12 x 12 in. side crank horizontal high speed engines direct connected to Canadian Westinghouse D.C. generators; one unit being 50 k.w. 250 volts, 200 amperes, 280 r.p.m., and the other 25 k.w. 25|250 volts, 100 amperes, 300 r.p.m. The generators are the 3 wire system, and furnish 220 volts for the motors and 110 volts for the lighting circuit. The engines are of the standard enclosed, forced lubrication type and were supplied and installed by the International Enginering Co., Ltd., Amherst, N.S.

The switchboard is of grey marble 5 ft. 6 in. x 5 ft. 3in. made in two panels and has the following fittings: Three ammeters, one voltmeter, and two circuit breakers, all supplied by the Canadian Westinghouse Co., Hamilton, Ont.

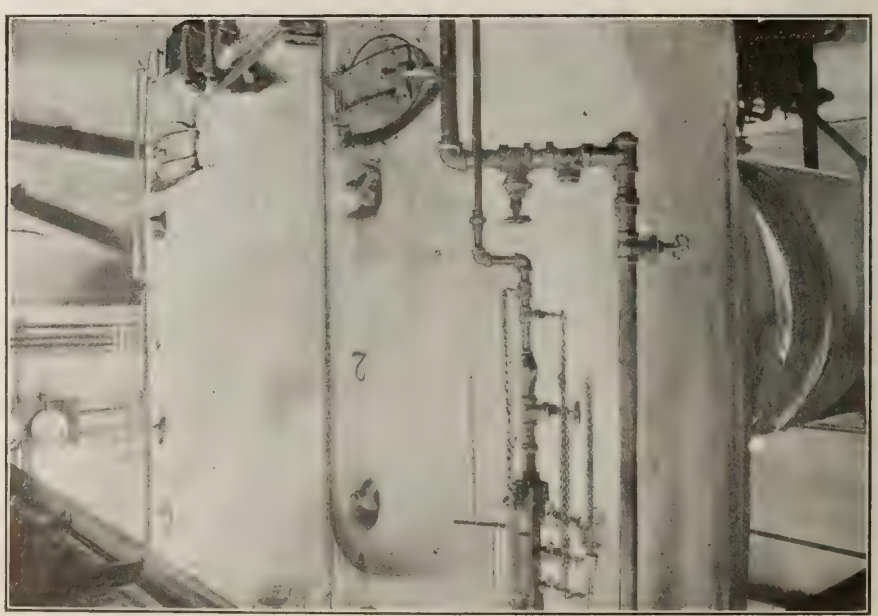


Refrigeration Plant.

Adjoining the engine room is the refrigeration plant consisting of a vertical "York" ammonia compressor, two brine pumps, condenser, etc. The plant is driven by a 13 h.p. Crocker-Wheeler motor and has a capacity of 8 tons of refrigeration every twenty-four hours.

The ammonia after leaving the compressor, passes through the condenser and is piped to the coils in the brine tanks in the refrigerators located near the kitchens; the brine being cooled by the ammonia expanding and absorbing its contained heat. Pure ice is made by placing galvanized iron tanks filled with distilled water in the brine tanks. The brine is circulated by the pumps already referred to. This installation was carried out by the Kent Co., Montreal.

In the same room as the refrigerating plant is a sterilizer for providing pure water for drinking purposes. This apparatus furnished by the Forbes Co., Philadelphia, consists of a vertical cylinder containing water which is boiled by live steam from the main boilers. The water is first of all cooled in another vertical cylinder, and then passes into a tank containing a coil connected with the ammonia condenser. Here it is finally cooled and is pumped through the build-



FITZGIBBON BOILERS, WELLESLEY HOSPITAL.

ing by a vertical triplex "Deming" pump driven by a ½ h.p. motor, and supplied by Darling Bros., Montreal.

Laundry Equipment.

The laundry is equipped with the latest type of machinery, same being supplied by Meyer Bros., Toronto. All the machines are electrically operated, Crocker-Wheeler motors and Cutler-Hammer starters being installed throughout. The equipment consists of one 36 in. x 54 in. turbine metal washer operated by a 3 h.p. motor. An interesting feature about this machine is the apparatus which controls the reversing motion of the cylinder of the washer, without changing the direction of rotation of the motor. This device has been developed by the General Electric Co.

For the preliminary drying of the clothes a centrifugal dryer is installed, operated by a 2 h.p. motor. For the final drying, a dry-room tumbler and dry room are used. The former is 36 in. x 42 in. and is driven by a 5 h.p. motor which works in conjunction with a patent reverse control apparatus, similar to the device fitted to the washer. There is a set of steam heated coils under the tumbler, and a fan circulates warm air through the dry room.

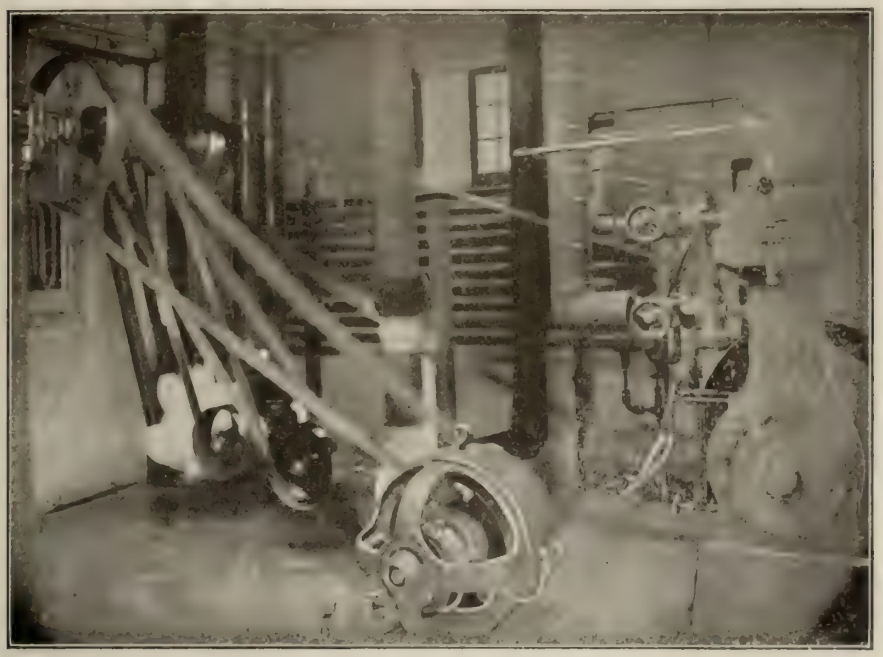
In the centre of the laundry is a triplex ironer, the rollers being heated by steam and driven by a 1 h.p. motor. Adjoining this machine is a body iron with rollers heated by electricity and driven by a ¾ h.p. motor. One special feature about this machine is the fitting of the electrical elements, these are laid in soapstone, it having been found that this material gives very satisfactory results for this class of work. Other equipment includes a starch cooker, electric irons, and a fan for ventilating purposes.

Heating and Ventilating.

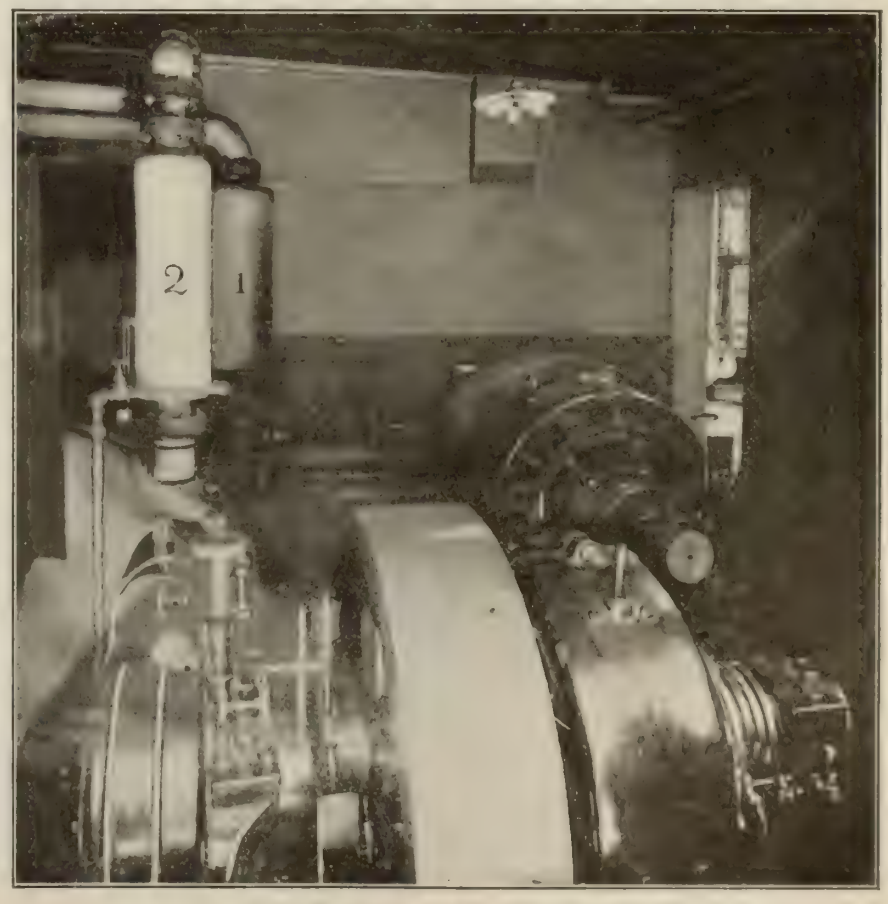
The hospital is heated throughout with radiators supplied with exhaust steam. There is also an arrangement whereby, if necessary, live steam can be admitted at a reduced pressure. Each radiator is fitted on the inlet end with a D.G.C. control valve, and on the outlet end with a modulating valve of the same make; this valve permits water only to pass, retaining the steam in the radiator. The radiators are specially designed for hospital work, having ample room between the coils so as to be easily cleaned.

A ventilating system has been installed independent of the heating system. In the basement are located an "Eclipse" air washer with a capacity of 12,000 ft. per minute, and "Vents" cast iron tempering and re-heating coils. Water for the air washer is supplied by a centrifugal pump driven by a 2 h.p. C.G.E. motor, and a Sheldon fan operated by a 3 h.p. Bruce Peebles motor circulates air through the building. On the roof are two Sheldon fans, each operated by a 3 h.p. Bruce Peebles motor, one fan exhausting the air from the main system and the other from the lavatories and kitchens.

The temperature of the air in the ventilating system is controlled by an apparatus supplied by the Canadian Powers Regulator Co., Toronto, and which consists essentially of a series of thermostats and diaphragms operated by compressed air supplied by an air pump. Thermostats are located on either side of the air washer, one controlling the diaphragms connected to the tempering coils, and the other controlling the diaphragms connected to the reheating



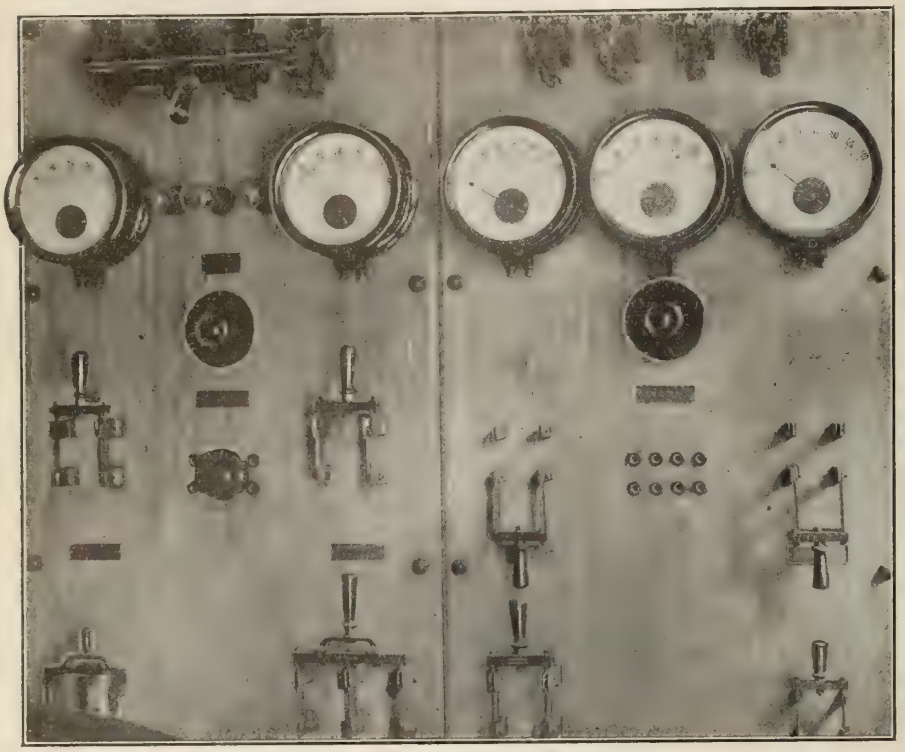
AMMONIA COMPRESSOR AND BRINE PUMPS.



ENGINE ROOM, WELLESLEY HOSPITAL.

coils, the latter regulating the final temperature.

The control is arranged for by means of compressed air which operates the



SWITCHBOARD WELLESLEY HOSPITAL.

diaphragms when the desired temperature has been reached. The thermostat controlling the re-heater is set to operate at a certain prescribed temperature, allowing the air to act on the diaphragms and shutting off the supply of steam to the coils. Compressed air is supplied by a "Powers" air pump which supplied air at 15 lbs. and is operated by city water. The pump is automatic and supplies air as required, being fitted with a valve which controls the supply of water to the pump.

Elevators,

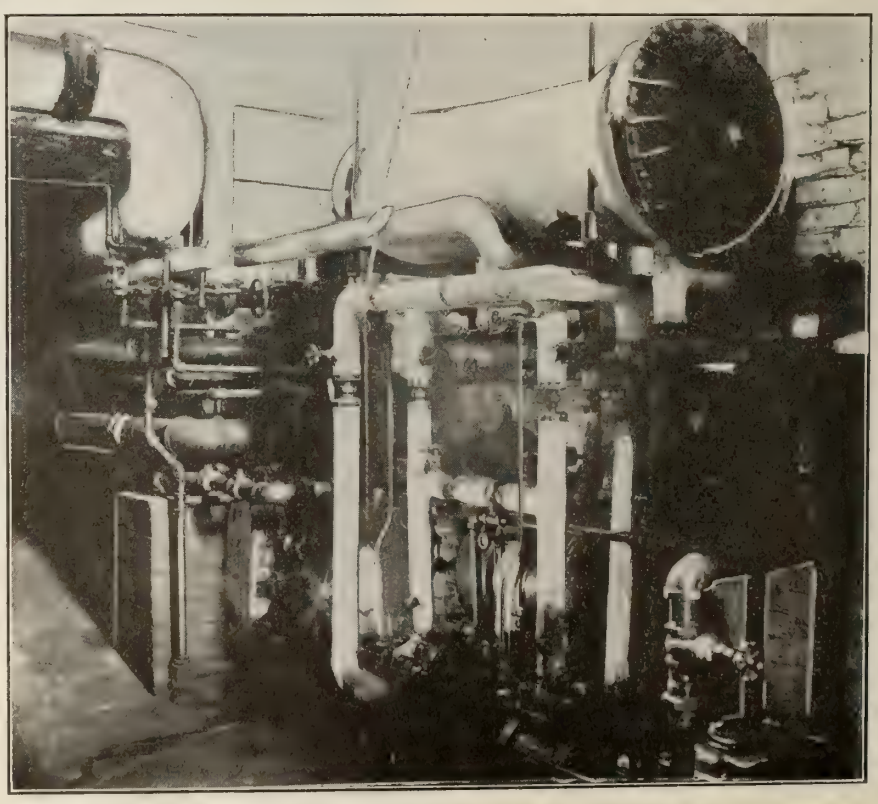
The elevator equipment consists of one electric passenger elevator, with full automatic push button control, and one automatic push button controlled dumb waiter. The automatic control dispenses with the necessity of employing an elevator attendant. The passenger elevator has a capacity of 2,000 lbs. at a speed of 120 ft. per minute, and is operated by a 10 h.p. Steven Motor.

After all the gates guarding the elevator-shaft are closed, the pushing of a button on any floor brings the car to that floor. After the car has once started to move to that floor, the pushing of a button at any of the other floors does not affect it; that is to say, one journey must be completed before the elevator will respond to another call. No gate can be opened until the car is opposite the landing; neither can the car be started until all the gates guarding the elevator-well are closed.

Inside the car there is a push button corresponding to every floor served by the elevator. After the passenger leaves the car, the gate must be closed before the elevator can be called into use by other people. The push button in the car or on the landings completely control the elevator. There is an emergency switch in the car (colored red) for correcting mistakes; thus, should anyone push the button representing the third floor, in mistake for the proper floor, by operating this switch the car stops, and thereafter pushing the right button, the car will then go to the desired floor. In addition to the above buttons it is equipped with "up" and "down" buttons. These perform the function of bringing the car to the floor levels. If the car is above, press the "down" button till the car is opposite the floor, then release the button; or if the car is below the floor level press the "up" button in the same manner. In addition to the safety devices mentioned, the elevator is equipped with all the latest safety devices as required by the City of Toronto regulations, and makes it as safe as it is possible for human skill to accomplish.

Regarding the push button controlled dumb waiter, by pushing a button, the waiter will come to the floor from which the button is pushed. After you have loaded or unloaded the waiter, as desired, you can again send it by pushing a button to the floor desired, and the travel of this cannot be interfered with by anyone pushing a button at any of the other landings. It will continue its journey until it has completed the trip for which the button was pushed.

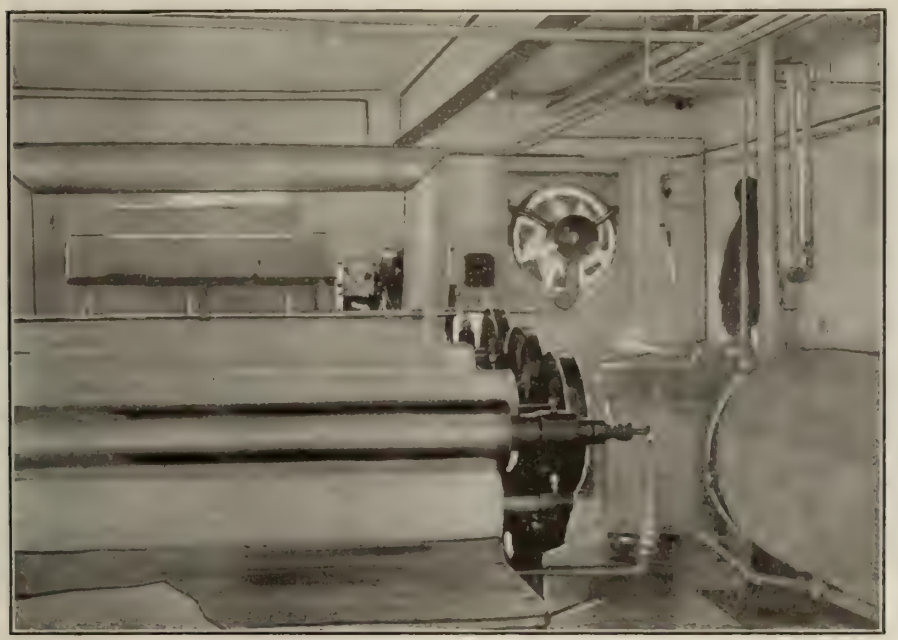
The elevators were manufactured by A. & P. Steven, of Glasgow, Scotland, and installed under the supervision of W. Bruce Morrow, Toronto.



PUMPS AND HEATER. WELLESLEY HOSPITAL.

Nurse Call System.

The nurse call system is an interesting feature. At the head of each patients' bed is a push button and a release. These buttons are connected with a red lamp located over the outside of the door, and also with a lamp signal annunciator at the nurses' station, indicating the room from whence the call has been sent. The lamps cannot be extinguished except by pressing the release button at the patient's bed. This installation is supplied with current from a series of batteries, and was installed by Geo. J. Beattie, Toronto.



CORNER OF LAUNDRY, WELLESLEY HOSPITAL.

Kitchen.

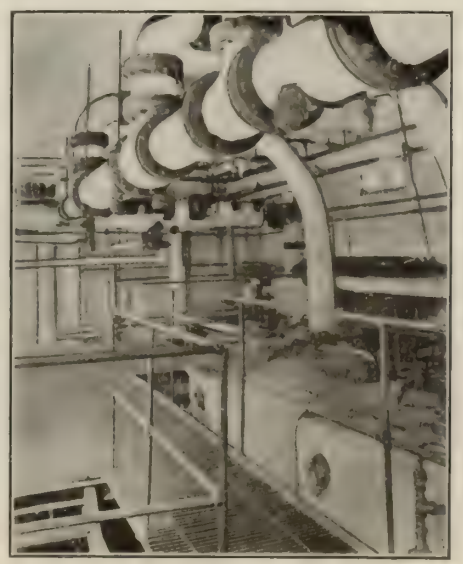
The kitchen, pantries, etc., are located in the basement and are bright and well ventilated. The principal equipment consists of a Gurney Oxford gas broiler, wtih steam roasters, vegetable cookers and soup kettle furnished by Geo. Sparrow & Co., Toronto; and a "Sterling" potato peeler and icebreaker driven by motor. Steam and odors are carried away from the kettle and roasters, etc., by ventilating pipes, and a ventilating hood completely covering the broiler carries away the excess heat and odors from that apparatus.

General Features.

Hot water for service purposes is supplied from a "Sims" heater located in the boiler room and heated by exhaust steam. The temperature of the water is controlled by a "Powers" regulator fitted in the hot water supply pipe. This regulator can be set to operate when the desired temperature is reached, by means of a diaphragm shutting off the supply of steam to the heater.

The lighting circuit carries 110 volts, the wires being laid in iron conduits. Carbon and Tungsten lamps are used, varying from 40 to 100 watts. The operating room is furnished with a special type of lamp suitable for the purpose. A "Pyrofuse" incinerator is installed in the basement and was supplied by J. B. Prescott & Sons, Webster, Mass.

A system of electrically controlled clocks has been installed, there being eight in number, and located in various parts of the hospital. They are all controlled from a master clock in the Superintendent's office, and supplied with current from a 1 h.p. motor generator and battery located in the basement. The nurse call system obtains current from the same set. The clocks were supplied by the Stromburg Electric Co., Chicago, Ill.



PIPING OVER BOILERS

A vacuum cleaner system is installed. An "Invincible" three stage turbo centrifugal fan machine operating at 3,500 r.p.m. and driven by a 3 h.p. C. G. E. Motor is located in the basement. The machine which has a capacity of 160 ft. per min. is connected to piping installed throughout the building. The plant was installed by the Invincible Renovator Mfg. Co., Toronto.

NO BOILER EXPLOSIONS.

JOHN W. PECK, chief inspector of machinery for the British Columbia Government, whose department includes the inspection of boilers, in his annual report for 1912, says that there were no boiler explosions in British Columbia in that year. There were three fatal machinery accidents only, and these were not due to any defect in the machinery. All three occurred in District B, which is Vancouver Island, the province being divided into four inspection districts, with headquarters in Vancouver.

It is significant of the industrial growth of the province that the number of new boilers inspected last year was 621, as compared with 287 in 1911. The inspector also notes that out of 968 plates for new boilers inspected in 1912, only eight were condemned, which is the best showing made by boiler plates in this province since the department was organized. The total number of new boilers on the books was 4,561.

As might be expected, the demand for steam engineers of all four classes brought forward a number of candidates for certificates in 1912. In all 1,113 men were examined, of whom 768 passed successfully. The majority of the candidates sat for fourth class certificates, there being 563 of these, of whom 346 passed. Only nine tried for first-class certificates, and 109 logging-donkey engine certificates were issued and 15 special locomotive.

CLEANING GAUGE GLASSES.

ACCORDING to a contemporary, a a good way to remove deposits or stains from the glass gauges on steam boilers is to remove the glasses and soak them in the following solution:—Water, 6 oz.; salt, 1 oz.; acetic acid, 1 oz. After the glass is thoroughly moistened put some baking soda inside and place back in the solution. A gas is evolved that removes the iron or calcium stains in the tube. The solution is harmless to the hands. A cloth drawn through the tube dries it and cleanses remaining spots.

DISASTROUS BOILER EXPLOSION AT MIDLAND, ONT.

TWO men were killed and three injured in a boiler explosion at the sawmill of Manly Chew, Midland, Ont., on the morning of Oct. 21. The installation consisted of a battery of four boilers, and, looking from the front, it was No. 2 that exploded, counting from left to right. Why it exploded has not yet been determined. A jury empannelled to inquire into the cause of the death of one of the men, returned the following verdict:—

FIG. 1. FUEL HOUSE ON RIGHT, WHICH WAS MOVED SIX FEET. ALSO NO. 1 BOILER AND STACK.

"That the jury find that H. A. Sagar came to his death on Oct. 21st, 1913, at Mr. Manley Chew's mill by the explosion of a steam boiler, the cause of which is unknown, and, that his death, from the evidence given was purely accidental. We would recommend that the Government be requested to apply the same thorough tests to stationary boilers used for power purposes as that applied to marine boilers, and that a copy of the evidence and this verdict be sent to the attorney-general."

The jury was a very capable one, the foreman being a man who has had considerable experience with the operation of boilers.

The explosion being one of the most disastrous and, therefore, most important to occur for some time, the Government and several insurance companies are taking a keen interest in the matter. It is significant, however, that the boilers in this saw mill were not insured.

The mill had been running less than an hour on the day of the explosion. The engineer was in the engine room, and escaped; the fireman was in the fuel house, the small wooden building seen in the photograph, and he too escaped. Harry Sager, who was killed, was assisting to fire the boilers, and was blown through the brick wall, it is believed. The other victim, Freddie Fraser, aged 18, was a teamster, and was standing at the boiler house door, where he received the full force of the explosion, and was buried in the debris. Part of his wagon is seen in Fig. 5.

The boiler-room measured 130 x 40 feet, was of brick, and was completely demolished. It contained four horizontal return tubular boilers, 66 ins., diameter, by 14 ft. long, operating at 90 lbs. pressure. Each boiler contained 76 iron tubes 3½ ins. diam. All the tubes were blown out of the front head, Fig. 5.

The boiler shell was of 5-16 inch plate, and the heads of 7-16 inch iron plate, with double riveted, lap jointed longitudinal seams, having ⅝ inch rivets of 2 5-16 inch pitch. The circumferential seams were single riveted lap joints, with ⅝ inch rivets of 2 inch pitch. The heads were braced by two double angles, back to back, 3 x 3 x ⅜ inches, secured by 17 rivets of ⅝ diam. in the bottom pair, and 13 rivets of ⅝ inch diam. in the top pair. There were four diagonal stays on the bottom angle, and two on the top angle. The palm of stays were held by two ⅝ inch rivets. The size of manhole was 15 x 10 inches, as near as could be measured, it being badly fractured.

When the explosion occurred, all the safety valves were working freely, and blowing off at 95 lbs. pressure. The safety valves were 4 inches in diam., and of the lever type. The face of the explosion must have been backward and downward, as half of the back course was left almost in its original position on the foundations. The top half was found about 200 feet behind the boiler setting, and on the other side of the picket mill, so that it must have been blown completely over the mill.

The tubes and back head went forward sixty feet. The shell was fractured in all directions, and torn completely off the back head, and partly off the front head. Lamination was visible in many parts of the plating.

Fortunately, the fire in the boilers was blown towards the front, and clear of any rubbish or fuel, otherwise the whole plant would have been demolished by fire.

FIG. 2. FRONT VIEW OF BOILER HOUSE TAKEN FROM THE RIGHT.

Another piece of good luck was the fact that the employes around the plant were few in number that day, or the loss of life would have been heavier. The building in the rear of Fig. 1 is the picket mill, which was partly wrecked, and usually employs a large number of boys.

FIG. 3. STEAM HEADER SHOWING THROUGH ROOF OF MILL.

In Fig. 1 the wooden building on the left is the fuel house. It was pushed six feet to the right. Fig. 2 gives a view of the wreck from the front of the boiler house, from the right hand side. Fig. 3 gives a view from the left of the boiler house at the rear, and shows No. 1 boiler lying near the fuel house. Fig. 4 shows No. 3 boiler blown on top of No. 4, and the smoke stack in several pieces lying near. The building behind is the mill. The photograph, Fig. 5 was taken from the left front of the boiler house. Fig. 2 being from the right. In Fig. 1 a piece of the steam header can be seen in the roof of the building.

The boiler was blown to fragments, and the rupture apparently occurred along the longitudinal seam, on the right hand side, at the front end. The damage done amounted to from $12,000 to $15,000.

The liabilities have not yet been settled, and will probably be determined in the courts. S. M. Medcalf, chief inspector of steam boilers for Ontario, is conducting an investigation into the affair.

Boiler Tubes.—What is the usual procedure in removing worn out tubes from horizontal return tubular boiler, and in replacing them by new ones; also, how are the tube ends beaded, and what allowance of tube beyond each head is required for the beading operation.—J. Langridge.

FEED WATER HEATING BY EXHAUST STEAM.

PERHAPS the most widely known use to which exhaust steam is put is for the heating of boiler feed water in heaters of the closed or tubular type, and the open or direct contact type. The utilization of the exhaust steam in this apparatus by furnishing hot water to the boilers instead of cold water effects a saving in fuel usually ranging from 12 to 15 per cent. of the total fuel burned under the boilers. It is an established fact that a saving of 1 per cent. in fuel is effected for each ten degree increase in the temperature of the boiler feed water.

The steam making capacity of the boiler is also increased in a like proportion due to feeding this boiling hot water ready to be flashed into steam. The elimination of temperature strains and contractions due to feeding boilers with cold water is also an item which materially improves the operating conditions. This heating of the water in open types of heaters also drives off air and gases which would tend to produce corrosion, and further improves the quality of the feed supply by precipitating out of it certain scale forming impurities as a result of driving off those gases which hold them in solution. Further, the exhaust steam which is condensed in this heating process, amounting to about one-seventh of the total feed supply, takes the place of just so much raw water, and thereby results in a considerable saving on water bills.

Oil Elimination.

The question of oil elimination can be approached from two sides: First, removing the oil from the steam before it is condensed by means of mechanical oil separators, and second, removing the oil from the condensed exhaust steam by means of chemical processes, filtration, hot well skimmers, coagulators, etc. Of the two methods mentioned, the first possesses many advantages in the way of simplicity, reliability and reduced cost, and cost of operation, which is practically nil. With the chemical and coagulating treatment there is a constant charge for materials and attention, while the elimination of oil by flotation makes necessary the constant wasting of a large amount of otherwise pure condensation. It therefore seems logical and more efficient to purify the exhaust steam as it leaves the engines, thus making it available in its purified state for any purpose desired.

FIG. 4. SHOWING NO. 3 BOILER ON TOP OF NO. 4.

The Subjects of Water Softening and Purification*--I.

By H. J. de Q. Lenfestey

The author of this article begins at the water source, and shows, step by step, the constituent changes which take place through atmospheric and earth crust contact. The disintegrating effect of rain water on rocks, etc., as it percolates through cracks and crevices, is dealt with at length, and the resultant water drawn from springs, wells and streams is shown to be that from which our boiler scale troubles arise and continue to exist.

IN a general way, all water is impure. Chemically pure water is composed of two gases—namely, oxygen and hydrogen, united together in the proportion of two parts by volume of hydrogen to one part by volume of oxygen, or one part by weight of hydrogen to 8 parts by weight of oxygen.

The first source of all natural water is the sea. By heat the water of the ocean is subjected to continual evaporation, rendering the air more or less humid; hence the atmosphere contains aqueous vapor, but in quantities varying greatly, according to a condition of the atmosphere known as its hygrometric state. The hygrometric condition is the ratio between the pressure of water vapour and the temperature of the atmosphere. The air can contain only a certain definite quantity of moisture or of water vapour at a given temperature and pressure. The humidity of the atmosphere is, therefore, limited, and, when that limit is reached, the air is said to be saturated. When this point is reached, the surplus is condensed and falls back on the earth in the form of rain to undergo anew the process of evaporation.

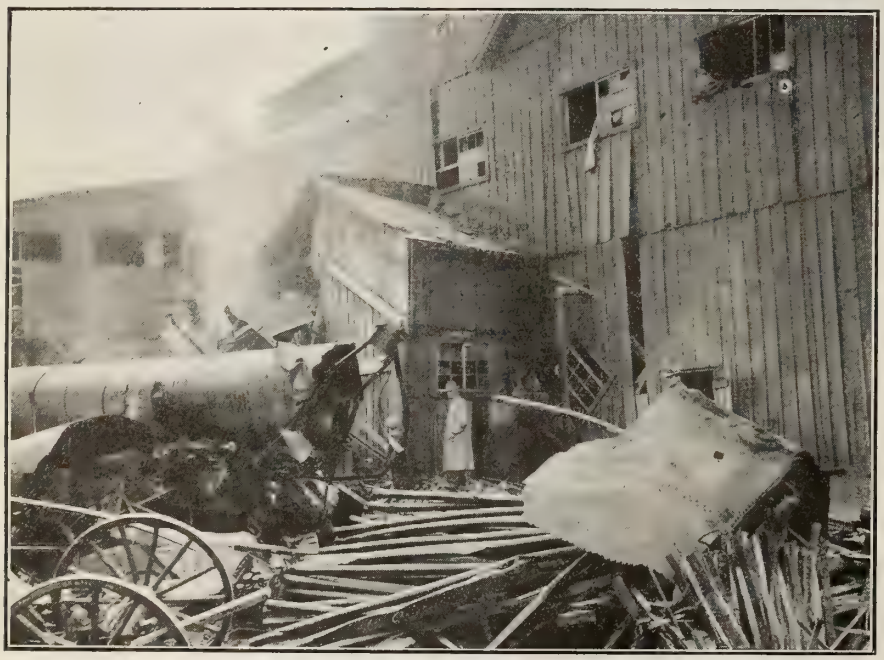


FIG. 5. FRONT VIEW OF BOILER HOUSE TAKEN FROM LEFT.

Rain Water.

Rain water is the purest form of water met with in nature, though rain water is actually never pure, for, in passage through the atmosphere, it dissolves gases of atmospheric origin, and the amount of such gases held in solution depends on the composition of the air through which the rain falls. Among the gases found in solution in rain water are oxygen, nitrogen and carbonic acid. The organic matter which is also found in the air is carried down by rain, and the quantity of this organic matter is greater in the vicinity of industrial centres. The presence of this organic matter makes it extremely difficult to preserve rain water, because of the objectionable transformation such matter undergoes, and as a result such water may be rendered unfit for domestic purposes, and injurious even in industrial operations.

Charged thus with the constituents of the atmosphere, the water falls on to the rock of the earth's crust, where its chemical action, exerted on the different bodies of which that envelope is composed, is the cause of various phenomena of transformation and disintegration. It is owing to the presence of these gases, and more especially to the further supply of carbonic acid which it takes up in its passage over the earth's crust, that the water is able to penetrate the rocks and exercise its powers of destruction and decomposition of even the hardest of them. This carbonic acid is produced by the decomposition of organic matter, or is the effect of the oxidation of combustible matter, or by the action of acids on limestone rock. The different substances in solution which have this destructive power on rock are likewise the cause of corrosion in steam boilers and of iron generally.

It is easy to understand that if water is capable of such vigorous action in nature, it must necessarily display similar energy in industrial uses, and even be able to get the better of substances endowed with a maximum of resisting power. Charged with oxygen and carbonic acid and organic matter, in its action on the rocks, water can convert anhydrous bodies into hydrates, dissolve mineral matter, produce carbonates, and separate the metals from the substances combined with them. We divide waters into two classes—soft waters, containing relatively very small quantities of the salts of lime and magnesia in solution, and hard waters containing relatively large quantities of these salts in solution.

In addition to the geological character of the land, a most potent factor in the production of hard waters, and waters unsuitable for boiler and other purposes, is the pollution of streams and canals by the various works situated on their banks. Not infrequently, substances more objectionable than mere scale formers are allowed to mix with the water traversing a manufacturing district.

Rain Action on Earth's Crust.

We will now proceed to investigate the action of the rain from the time it falls on the earth's crust. Owing to the porous nature of the rocks which form the earth's crust, and to the cracks and faults occurring in them, the water falling on the surface of the earth is able to penetrate into the ground. This water charged with carbonic acid gas and oxygen has a powerful disintegrating action on the material of the rocks, some of the constituents of which are chemically attached and carried away in solution. In this way the hardest rocks are worn away. By reason of the principle, by virtue of which water always seeks the lowest level, these waters in their passage into the depths of the earth absorb more and more carbonic acid gas from the abundant supply afforded by organic matter. The water

*From a lecture before the Nottingham Engineering Society.

being thus strengthened by this fresh supply of carbonic acid gas, the phenomena of chemical activity becomes more and more marked. As a consequence of the phenomena of oxidation, carbonation and decomposition produced by the excess of carbonic acid, the water loses more and more of these gases, especially the carbonic acid, which dissolves the limestone rocks with the greatest ease. Having reached an impervious bed, the passage of the water downwards into the earth is arrested, and it here collects and forms subterranean pools. These subterranean pools are sometimes of very great capacity, and the water eventually emerges again in the form of a spring. By sinking a shaft in the ground to the water line a well is formed. If the spot at which the shaft is sunk is at a level considerably lower than the highest point of the water containing stratum, the water spurts out as an artesian well.

The composition of a well or spring water varies according to the strata through which the water has percolated. Ordinary well water frequently contains a considerable quantity of the carbonates and sulphates of calcium and magnesium which renders it unsuitable for industrial and domestic purposes. In the case of shallow wells the water often gives off a marked odour of sulphuretted hydrogen, arising from the formation of sulphides by the reduction of calcium sulphate in presence of organic matter in the water. When the organic matter has become nitrogenised it is liable to be transformed, under the influence of certain ferments, into compounds of nitrogen, such as nitrites, nitrates and ammonia.

Water which takes up carbonic acid so readily will often just as readily release it. In nature the liberation of the carbonic acid is brought about by the action of marine organisms, and the final outcome is the deposit of carbonate of lime or magnesia. Thus, in the steam boiler, on boiling, the water releases the carbonic acid, and calcium carbonate is deposited in the form of scale.

Hardness in Water.

Having endeavored to show the means by which the most commonly found salts find their way into water, I shall now proceed to consider the effects which various salts found in water have in industrial processes. The salts which produce hardness in water are the following:—

Carbonates of lime and magnesia.
Sulphates of lime and magnesia.
Chlorides of lime and magnesia.
Nitrates of lime and magnesia.

The hardness of water is generally considered under two heads—temporary and permanent. The temporary hardness is that due to the carbonates of lime and magnesia, which are held in solution by carbonic acid, and which are thrown out of solution on boiling the water. The permanent hardness is due to the sulphates, chlorides and nitrates of calcium and magnesia, and these salts are not deposited when the water is boiled under ordinary atmospheric pressure. The solubility of calcium and magnesium carbonate is chiefly due to the presence of carbonic acid, and these salts are present in water in the form of bicarbonates. Calcium carbonate is soluble only to the extent of about 1½ grains per gallon in water freed from carbonic acid, but magnesium carbonate is more soluble, being soluble to the extent of seven grains per gallon.

Deposition of Scale.

It will thus be seen that when a water containing the carbonates of lime and magnesia is used for boiler purposes without previous treatment, practically the whole of these salts are deposited inside the boiler in the form of scale. When present by itself calcium carbonate does not tend to form much scale in a boiler of the Lancashire type, but deposits in the form of mud. In a water-tube boiler, however, it very soon completely blocks up the tubes, and will form a very hard scale in economisers.

Calcium sulphate is very soluble in water, its maximum solubility being the temperature of 95 deg. Fah., when it is soluble to the extent of 177.8 grains per gallon. The solubility gradually increases up to this point, and then gradually decreases, and at a temperature of 464 deg. Fah., corresponding to a pressure of 484 lbs. per square inch, it is soluble only to the extent of 12.6 grains per gallon. Calcium sulphate gives endless trouble when present in feed water of a boiler working at a high pressure. Calcium sulphate is deposited on the boiler plates and forms a scale of a crystalline nature as hard as flint, which can only be removed by chipping. Moreover, calcium sulphate is an exceedingly bad conductor of heat, and a scale formed of calcium sulphate will cause the boiler plates to become very much overheated, thus resulting in severe strains and shortening of the life of the boiler.

DEARBORN CHEMICAL CO. OF CANADA.

AN industrial development of interest, relating to the subject of water treatment as applied to steam boilers, is the new plant of the Dearborn Chemical Co., of Canada, Ltd., just completed at 1220-1230 Dundas Street, Toronto, which will be devoted to the manufacture of water treating preparations, according to scientific principles.

Definite knowledge of the nature of the water is the most important essential in setting about to better the plant conditions in so far as they are affected by the boiler feed water. For every effect there must be a cause—one water may give rise to scale formation, while others will cause foaming and priming, or corrosion; these differences in the behavior and action of the water being due to differences in the mineral ingredients, in the total amount of substances present, and to differences in the relative amounts of the several substances contained.

DEARBORN CHEMICAL CO. OF CANADA PLANT.

The Dearborn Company has devoted a quarter of a century to the treatment of waters, determining by analysis and study of the water and plant conditions, the necessary re-agents to counteract the combination of mineral salts found in the water supply, and selecting materials that will bring about satisfactory results without forming any injurious by-products as an after effect of the treatment.

Montreal, Que.—Proposals will be received at the office of the Board of Commissioners, City Hall, up till November 20, 1913, for purchasing, taking down and removing from the Low Level Pumping Station, Point St. Charles, a Worthington Duplex Pumping Engine, known as Pump No. 3, of a capacity of eight million Imperial gallons per day, the whole as set forth in specifications to be obtained at the office of the Superintendent of Montreal Water Works, City Hall. L. N. Seneeal, Secretary.

ELECTRICITY AND HYDRAULICS

This department is intended, in addition to individual treatment, to feature the close relationship existing between electricity and hydraulics in the power and light field.

CONTROL APPARATUS FOR ELECTRIC MAINS.

T has often been desired to control apparatus connected to public electric mains by some means which could be put into operation at the central station without the provision of special leads for the purpose. Many suggestions have been made, such as the reversing of the mains, or by earthing one pole at the station when it was desired to operate the distant mechanism. So far, however, no very practical result has been effected, as such means as those just mentioned have obvious disadvantages. Control from a distance is particularly desirable in the case of street lighting. At present clockwork switches are used to some extent so as to get over the difficulty, and where these are not used—and even where they are in use to some extent—a lamplighter is required to make his rounds in order to illuminate and to extinguish the lamps at the desired hours.

Apart from the question of the cost of labor involved, this method leads to the switching on many of the lamps considerably in advance of the time when they are really required, and, similarly, the extinction of a large proportion of the lamps is delayed beyond the hour when lamps are necessary owing to the fact that a considerable time is taken in making the rounds. So far, gas has been in a happier position, for it is possible to turn street lamps on or off by a variation in the pressure, and thus in competing against electricity for street lighting, gas has been at an advantage.

MONTREAL ELECTRICAL EXPOSITION.

A SUCCESSFUL electrical exhibition, under the auspices of the Montreal Electrical Society, was held at the Arena, Montreal, November 1 to 8. Though the majority of the exhibits perhaps appealed more particularly to the housewife, there were others that had a wider and more scientific interest. A booth which attracted considerable attention was that of X-Rays, Ltd. Here were shown a number of X-ray and other medical electrical instruments, among them being a small portable X-ray outfit, through which visitors were permitted to view the bones of their own hands.

The Montreal Light, Heat and Power Co. occupied extensive space in the hall, and exhibited electric toasters, stoves, radiators, together with ornamental table lamps, house fittings, etc.

The Montreal Electrical Society itself had an interesting booth where, amongst other things, was shown an electrical "museum," consisting of old-fashioned equipment of various kinds. They also showed a seven-roomed house to demonstrate how many economical uses may be found for electricity in the modern home.

One of the most interesting stands was that of R. A. Lister & Co., Ltd., Toronto. This firm showed in operation a Lister-Bruston automatic electric lighting plant, designed for house lighting in rural districts, where no central station supply is available. The exhibit consisted of a small low-speed vertical gasoline engine and a dynamo bolted to a common base, which also carries the jacket water tank. There is also a small battery of a few cells, similar to those used for ignition purposes on an automobile. This battery is kept fully charged by the dynamo. Three or four lamps may be operated from the battery, but when more are switched on, the extra current demanded causes a relay, or automatic switch, to act. The current from the battery then passes through the automatic starting switch and is delivered to the dynamo, causing the latter to operate as a motor and drive the engine until the latter commences to fire. When this occurs the power of the engine overcomes the motor effect of the dynamo which starts generating electricity, delivering current to the lamps and at the same time recharging the battery.. If the number of lamps in use is less than the number required to start the engine and if such lamps are required for a prolonged period, the voltage of the battery will drop, and this drop in voltage will also actuate the relay and so cause the plant to start up and recharge the battery. When all the lamps are switched off and the battery has been charged up to the standard voltage, the plant automatically stops. This exhibit attracted considerable attention and was in operation constantly each day, its automatic features being fully demonstrated.

Among other exhibitors may be mentioned:—

Tate Electrics, Ltd., Walkerville, Ont.; Electric motor trucks and automobiles.

Eagle Sign Co., Montreal; Electric signs.

Sayer Electric Co., Montreal; Lamps, shades, batteries, wireless telegraphy outfits, etc.

General Film Co., Montreal, motion picture projectors.

Schuman Electric Co., Lamps, radiators, electrical supplies.

The Society for Prevention of Cruelty to Animals showed an automatic electric cage for the humane destruction of dogs.

A number of booths were devoted to the demonstration of vacuum cleaners, washing machines and other household appliances. Genuine novelties were conspicuous by their absence, unless it be a novelty to see in an electrical exhibition two booths where real estate is sold as was the case here.

TESTING LARGE WATT-HOUR METERS.

THE testing of a large watt-hour meter is much more troublesome than that of a small watt-hour meter. The difficulties in making the test increase, perhaps, as the square of the load to be measured, if the difficulties may be regarded as being capable of numerical expression.

In the first place, the small flexible leads and wires of the small instrument are replaced by massive rigid bars or cables on the large instrument; so that it takes much more time to insert the testing apparatus in the circuit.

In the second place, any change in the geometrical disposition of bars or cables may alter the magnetic field at the tested instrument and thus affect its behavior. Moreover, owing to the large money value of the energy delivered by a large watt-meter, a higher degree of precision in its testing and checking is desirable. It thus comes about that the calibration

of large watt-hour meters in place is an undertaking requiring considerable effort and care, even if their working loads are steady. If their working loads are rapidly fluctuating, as on a traction system, standard indicating watt-meters become unsuitable, and standard watt-hour meters are necessary.

STEEL VS. CAST IRON PIPE.

EVIDENCE of local failure of cast iron or steel pipe is of little value in comparing the advantages of the two metals for water or gas pipe lines, unless one has evidence of the behaviour of both under similar conditions, as the conditions vary greatly with the nature of the soil in which the pipes are buried as well as with the analysis of the water or gas passing through the pipes. Cast iron pipes naturally have the advantage of being under ground longer than steel pipes, which have come into common use only during the last 20 to 30 years. The results which have been obtained up to date with steel pipes are so satisfactory that there is no reason why steel mains should not have a life as long as, if not longer than, that of cast iron pipes.

One of the first instances of the adoption of a steel main was for the water supply of Melbourne, Australia, more than 30 years ago, and the example of Melbourne has been followed by all the leading centres of population in Australasia, particularly during recent years, after an experience of 20 years or more in Melbourne which demonstrated the reliability and freedom from corrosion of the steel pipes.

Steel Pipe Coating.

The main feature to which steel pipe makers are now devoting attention is the coating of the pipes and this has now reached such a point of perfection that not only are the pipes amply protected from the effects of the surrounding soil and the flowing water, but they are able also to resist satisfactorily the effects of electrolysis. For example, it is found that when electric cables are laid in close proximity to cast iron gas or water mains, the effect is occasionally to form holes in the cast iron pipe almost as regular in form as if they had been drilled. In order to prevent this it is customary to link the cast iron pipes together with copper bands.

When, on the other hand, steel pipes are well coated with Dr. Angus Smith's solution and wrapped in tarred Hessian, the effects of electrolysis are practically eliminated. This is found to be the case in large centres in the British Isles where steel pipes are used to avoid the trouble which was experienced with cast iron pipes under electric tramway installations. The steel pipes are cleaned before they are dipped hot in a hot bath of coating solution, and as the coating adheres more easily to hot steel than to cast iron, it is natural that the efficiency of a coated steel pipe is better than that of a coated cast iron pipe which is more or less porous.

The Failure Features.

A few failures of steel pipe installations have been reported from time to time, but, when the causes of the failures have been thoroughly investigated, it is a question whether, under the same conditions, a cast iron pipe would have been able to show as good results. For example a steel main of about 39 miles in length was furnished to the town of Port Elizabeth, South Africa, and after about ten years' operation some portions of the pipe were reported to be corroded. Two well-known South African engineers were appointed to investigate and report on the condition of this pipe line. Their interim report was published about July of this year, and shows that while some corrosion has taken place in portions of the line, other portions are in first-class condition and that as far as external corrosion is concerned there is no need for alarm.

When this report was submitted, the engineers had not examined the pipes for internal corrosion, but the town engineer, who was appointed to report jointly with the consulting engineers, stated, that, as far as he was aware, no internal corrosion had taken place.

The pitting was due in some places to sulphuric acid resulting from oxidation of the pyrites in the soil. Six samples of the soil were analyzed at another section and were found to contain a number of pyritic and manganitic nodules and the pitting action was due to magnesium chloride and sulphuric acid resulting from the weathering of the pyrites. The action in the above cases was accelerated by the presence of brak water containing a large quantity of salts and disolved solids amounting to not less than 1.0031 per cent. of volume.

It is evident that the conditions through which portions of this main pass are very destructive, as sulphuric acid is well known to be a very active solvent of cast iron and steel. It is quite certain that under similar conditions corrosion would be induced no matter whether the pipes were made of cast iron or steel.

The pipes used for the Port Elizabeth works were not wrapped with Hessian, whereas the practice adopted in Canada by all engineers who use steel pipes is to have them covered with this Hessian coating. Had the Port Elizabeth mains been wrapped with the Hessian no trouble would have been experienced notwithstanding the corrosive nature of the soil.

The good features of steel pipes are well known to water works engineers who have in the past been troubled by broken pipes and flooded streets. About 500 to 600 miles of sizes varying from 2 in. to 72 in. in diameter, are already in use in Canada for gas and water mains, and the demand is increasing rapidly from all parts of the country.

POWER DEVELOPMENTS NEAR MONTREAL.

HYDRO-ELECTRIC development in the Montreal district has made rapid strides of late, and is on a scale that anticipates a large demand for power in the near future. The Laurentide Company's new plant, which is expected to be completed next spring, will increase the development at Grand Mere to 80,000 horse-power, which capacity can be further brought up to 100,000 horse-power at comparatively low cost. A considerable portion of this power will be available for purposes outside of those of the company. The present development at Grand Mere is 22,000 horse power.

The Cedar Rapids plant, with an initial capacity of 100,000 h.p., and 160,000 aimed at ultimately, will, according to the latest reports, be ready by the autumn of 1914, according to the original plans.

With both the Cedars and the new Laurentide plants in operation, and the extensions carried out at Shawinigan this summer completed, the hydro-electric development in the district of which Montreal is the centre should be upwards of 400,000 horse-power by the end of 1914. This is exclusive of the plans of the National Hydro-Electric Co. at Carillon, of which comparatively little has been heard recently, but which aim at a development of 160,000 h.p. The Montreal Light, Heat and Power Company's water powers at Chambly, Soulanges and Lachine, the Canadian Light & Power's plant at St. Timothee and smaller plants account for 100,000 horse-power in addition to the foregoing.

The following table gives the total development in horse power of hydro-electric plants in and around Montreal, which should be available by the end of 1914, together with the announced extensions in view:

	Dec., 1914.	Planned
Shawinigan	140,000	.....
Do. hydraulic ...	45,000	.....
Cedars	100,000	160,000
Soulanges	15,000	.....
Chambly	20,000	.....
Lachine	12,000	.....
Laurentide	80,000	100,000
Can. L. & P.	30,000	.....
National H.-E.	.....	160,000

REFRIGERATION DEPARTMENT

CONCERNING MECHANICAL REFRIGERATION.*

IN general, it may be said that almost all methods of obtaining refrigeration are based upon the fact that when a liquid evaporates or turns from a liquid into a gas or vapor, it absorbs heat from its surroundings. There are a number of liquids which are easily made to evaporate and produce this cooling effect, and but for their cost, refrigeration could be very simply produced by supplying a steady stream of the liquid and allowing the vapor or gas evaporated to escape into the atmosphere. A refrigerating machine is practically an apparatus for saving this gas which has evaporated, and returning it to its liquid form to be used over again. In this process of recovery and condensation, the gas gives out the heat which it has previously absorbed in evaporating. This heat is carried away by flowing water which absorbs it. The operation of a refrigerating machine thus causes a continuous cycle of evaporation, recovery and condensation. There are two general systems in use for producing refrigerating effects, the compression and the absorption.

Compression System.

In the compression system, the recovery of the gas is effected by drawing it away from the point where it has been evaporated and pumping it under increased pressure into a chamber where it gives out its heat to the water-cooled walls of the chamber, and returns to the liquid state ready to be used over again. A number of liquids have been used in compression refrigerating machines, those common being ammonia, carbon dioxide and sulphur dioxide.

With carbon dioxide the advantage is in its lack of offensive odor. Its advantages are the extremely high pressure at which it works, i.e., 300 to 1,200 pounds per square inch, the difficulty of holding these pressures, and also the difficulty of finding small leaks because of its lack of odor. With ammonia, the advantage is the lower working pressures, which are easier to deal with 15 to 300 pounds per square inch. Leaks are easily detected by the odor. With sulphur dioxide, the advantage is that it operates at very low pressure—not above 75 pounds to the square inch. Its great disadvantage is that with moisture it forms an acid which rapidly corrodes the apparatus. At one time this disadvantage was fatal, since, with the old type of machine, air and moisture were constantly being drawn into the system more or less rapidly, and mixed with the sulphur dioxide. This difficulty has recently been overcome by the Audiffren type of machine in which the refrigerant is hermetically sealed in the machine and chemical action therefore cannot occur.

Absorption System.

In the absorption system, ammonia is generally used, and the recovery of the gas is effected by bringing it in contact with water with which it unites chemically. The solution thus formed is pumped into another chamber where the ammonia gas is driven off again by heating the mixture, and is then condensed under high pressure. In the absorption system, the liquid ammonia as it is released by the expansion valve passes into the low pressure portion of the apparatus, the expansion piping, which is located at the point where the cooling is to be done. While expanding, the ammonia absorbs heat as it passes, and is carried to the absorber. This is a vessel of cold water. The strong affinity of ammonia gas for water causes a ready combination, and a constant sucking is produced tending to reduce the pressure in this section of the apparatus, thus permitting the expansion of the ammonia gas.

After being absorbed, the weak ammonia is pumped into another compartment called the generator, where the ammonia gas is driven out of the water by heat. The hot ammonia gas is then passed through a condenser to be liquefied. The condenser is a series of pipes arranged in vertical rows and cooled by flowing cold water. The liquefied ammonia is collected in the ammonia receiver to be again used through the same cycle of operation. The hot liquor-water, from which the ammonia has been boiled, is pumped out, cooled and again used in the absorber.

Capacity Features.

Refrigerating machines are now on the market having capacities as low as 1/8 ton of refrigeration. The price of this apparatus is such as to be attractive to owners of residences costing $20,000 and upward, and also for all classes of commercial installation. Recent developments in this class of machinery overcome the particular mechanical difficulties in applying refrigerating machines to smaller service, such as domestic installations, etc., while, with the use of one type of machine on the market, ammonia is avoided, and the necessity for stuffing-boxes and pipe joints is done away with. The limitations in the application of this class of machinery are now practically the noise of the motor and the noise of the water and brine circulating in their tanks. This can in most cases be overcome by properly locating the apparatus in the basement of a building.

While the capacity of refrigerating machines is generally expressed in terms of the effect produced by the melting of a certain amount of ice per day, we suggest that in meeting the average customer it is preferable to state the machine capacity per hour instead of per day, since this immediately suggests the possibility of running the machine as many hours as may be necessary to produce the effect required. For instance, a machine that will produce 16 pounds of ice melting effect per hour may fulfill the requirements of some particular case in 4 hours, producing practically 65 pounds of ice melting effect in that time, whereas if this machine were referred to as having 1-5 ton capacity per day the customer would immediately think of it as too large for his requirements. This plan, of course, involves the use of a brine storage tank to maintain the proper degree of refrigeration when the machine is not running.

Size of Machines.

The figures used in determining the size of refrigerating machines required for given work ordinarily give the result much too small. Figures determined as follows will check well with practice: Heat enters refrigerated compartments through the walls, in warm goods, by the interchange of air with the outside through the opening of doors and by air leaks, since the cooled air is the heavier and immediately flows out when a door is opened, from lamps or the heat of the bodies of the workers, and from any change of stage occurring in the goods, such as freezing, fermenting, etc.

*From National Electric Light Association Committee report.

In large rooms these sources of heat should be analyzed separately. In small refrigerators, as, for instance, hotel, kitchen, domestic refrigerators, etc., a rough rule that is quite as accurate as a more elaborate analysis allows a certain number of B.t.u. per cubic foot of refrigerated space per 24 hours. This amount varies with the character and location of the box, the nature of its insulation, the temperature desired, and so on.

It will be seen that the insulation while of great importance is not by any means the only important factor in this class of boxes. For domestic boxes, held between 35 and 50 degrees, allow 300 B.t.u. per cubic foot of refrigerator per 24 hours; for boxes in hotel or restaurant kitchens allow 600 or even 900 B.t.u. in extreme cases, and where low temperatures are required, and for butchers' coolers, or large storage boxes, allow 200 to 250 B.t.u. per cubic foot per 24 hours.

Small Machine Requirement.

With small machines it is more necessary to allow a generous capacity of machine for a given size of box than with large machines, since in the latter, one can always throw a large part of the capacity to any given box where special need may exist, whereas to do this with the small machine would almost certainly rob some other box, if indeed there happened to be another. It is never possible to determine with mathematical certainty how much refrigeration is required for a given case. Therefore, it is best to allow for this fact and be sure the machine is amply large.

Where an existing ice-cooled box is to be cooled mechanically, one check upon the size of machine required is the amount of ice used. This check is more apt than any other, however, to lead to erroneous conclusions unless the figures are properly analyzed. The following method, while apparently cumbersome, gives good results.

Determine the ice consumption for the hottest month of a year. This will give the average ice consumption for that month. Determine accurately the average temperature that is secured in the box with ice. This will usually be from 55 to 65 degrees. It is commonly stated anywhere from 40 to 45 degrees, but these figures are so seldom obtained as practically to warrant the statement that they are never reached. Even if they are secured at all with a full ice chamber and the box closed for long periods, the average will be well above them, therefore, unless positive assurance is had to the contrary, figure on 55 to 60 degrees as the average temperature.

Calculate the heat inflow through the insulation with a temperature of 55 degrees in the box and with the average summer temperature outside. The difference between the heat inflow through the insulation and the total actually absorbed by melting of the ice is the amount entering the box from other sources than through the insulation. This access of heat ordinarily occurs during the day only; i.e., when the box will remain closed.

A machine of sufficient capacity to produce the temperature actually obtained with ice must, therefore, be of larger rated capacity than that indicated by the actual ice consumption. How much larger can be determined by the method given.

A further fact to be taken into account in determining the proper size of machine is that temperatures obtainable with ice are not satisfactory. If they were satisfactory, the greatest reason for putting in cooling machinery would be done away with. Where 55 degrees are obtained by ice, 35 to 45 degrees will be required with mechanical cooling and the machine must be further increased in the ratio of the temperature differences between average summer temperatures and 35 degrees and average summer temperatures and 55 degrees.

Again, the cooling machine if installed in accordance with these figures would handle average weather conditions, but would not be adequate for extremely hot weather conditions, the most important condition to be met by cooling machinery. It is necessary, therefore, to further increase the size of the machine in the ratio of the difference in temperature between maximum summer temperature and 35 degrees, and the average summer temperature and 35 degrees. In many cases, for one reason or another, it is not possible or else not desirable to operate the machine except during certain parts of the day, and the machine size must be increased as much as may be required to take care of these conditions.

Finally, if the machine is not placed directly at the box to be cooled, allowance must be made for the heat inflow into the insulated brine mains. The amount of heat entering from this source is often of considerable importance, particularly with small machines.

AIR CYLINDER LUBRICATION.

THE following data relative to the lubrication of air compressor cylinders appear in a pamphlet issued by the Fidelity and Casualty Company, and in view of the fact that air compressors form, in a large number of instances, a highly important feature of power plant equipment, the information should be not without interest to a wide circle of our readers.

"Recent disastrous explosions in air compressor systems present striking examples of the danger existing from use of ordinary engine oil in the air cylinders. Only a pure mineral oil, with a flash point as high as good lubricating qualities will permit, should be used. An excessive amount of oil should be kept out of the system.

"Numerous cylinder oils are compounded, and such oils are likely to produce a carbon that will stick the valves, and collect on the valve faces and other parts of the cylinder and valve chambers, resulting in a dangerous condition.

"Air receivers are liable to explosion from accumulated oil deposits. Every receiver should be equipped with a pressure gauge, a safety valve, and proper drains, and all reservoirs and likely places of deposit in the air line should be thoroughly and frequently drained and cleaned. It is bad practice to have the inlet of an air compressor taken from a hot or dusty room—the air should be cool and as clean as possible.

"The practice of throwing kerosene oil into the inlet of an air compressor to clean it is an extremely dangerous one, and the cause of an explosion under such circumstances is not difficult to understand. Lubrication of the air cylinder with soap-suds (preferably made of soft soap, about one part to fifteen parts water) for a few hours each week (or less frequently if the load is light), instead of oil, will help very materially in keeping the cylnder clean. The only danger from the use of soap-suds is rust, and this should be overcome by being careful to discard the soap and feed the cylinder with oil an hour or so before shutting down. The receiver blow-off should then be opened and the accumulation of oil and water drained off.

"An air compressor engine should not be controlled by the air pressure alone, as many are, but should be fitted with an auxiliary governor which will act as soon as the speed rises above a certain predetermined limit. This will prevent the engine from "racing," in case an accident to the tanks or piping causes a sudden lowering of the pressure. It is not necessary for an explosion to take place to produce a lowering of the pressure, as the giving way of a pipe, valve, or tank from any cause will have the same effect.

"The steel used in the construction of air receivers should be of the best quality, and should have a tensile strength of from 55,000 pound to 62,000 pound per square inch. The side seams should be double-riveted, or better still, be butt-strapped. The heads should be dished. The large sizes of receivers should be provided with man-holes."

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THE TRAGEDY OF OUR GREAT LAKES.

AS we go to press, there are still being unfolded the harrowing details of the greatest combination of disasters that has yet befallen the shipping on the Great Lakes of this continent. Ranking, in recent years, perhaps next to the foundering of the Titanic, 18 months ago, in general importance, but taking premier place and making record so far as Canada is concerned, in the matter of the loss of brave men and things material, we think it meet that reference should be made in the columns of this journal to the overwhelming sorrow which has taken possession of all of us, and to the sympathy we are constrained to extend to those bereaved, because of the untoward, and might we say unpreventable tragedy, in which they have been made participate.

You operative engineer readers are kin to the man on the starting platform at the tank top level, as well as to him who feeds the coal to the boilers, and we somehow feel that in this hour of calamity your pulse beats some faster when you realize that your brother, met his death doing his duty.

And what of the other men, equally faithful, whose duty demanded that exposure to the full fury of the blast on deck and bridge be their shroud!

EPIDEMIC OF BOILER EXPLOSIONS.

CANADA holds the world's record for fire losses per head of population, and if recent happenings are any criterion, she is out to secure the like unenviable reputation in the matter of steam boiler explosions. The latest of these constitutes a shocking record in both life and property, and the wonder of it all is that many more innocent and unsuspecting mortals were not hurled unceremoniously into eternity. The illustrations accompanying the article in another part of this issue give ample evidence of the material devastation wrought by the explosion. The official investigation is still pending, and may, on its conclusion, be expected to give us definite information, as to not only the ultimate, but contributory causes as well, of the disaster.

It should be needless for us to point out here, and in this age of engineering knowledge and practice that this latest or any other explosion is something that did not develop suddenly and then go off. A more or less extended period of probation and preparation preceded the eventuality, and just whether carelessness or want of regular qualified and expert inspection—Government or Insurance Co.,—indifference or negligence of proprietor, carelessness or incompetence of attendant, or an unfortunate combination of two or more of these preceded the explosion, it remains for a searching inquiry to unfold.

The demand for the encouragement and development of higher degree skilled supervision and operation of steam power plants as indicated by the desire for graded certificates is one that cannot be much longer ignored by the authority responsible for the legal enactment of same, and let us say here that the present requirement for an operative engineer's license is one of the most elementary, primary and uncomplimentary valuation of the man's work and possible achievements ever devised. It is, therefore, up to the operative engineer, if he would retain his self respect, to individually and collectively press this graded certificate question in season and out of season to a successful termination, and to actively campaign against the employment of men to operate and attend our steam boilers, who are so palpably ignorant of their work as to be incapable of acquiring the already referred to existent license, and who are a menace to the public at large and to the conservation of our created productive equipments.

We receive letters repeatedly from our subscribers relative to the employment of uncertificated incompetents, and we go on record by saying that such a state of affairs need not and could not exist, if efficient tab were kept by those deputed to attend to this particular feature. Something in the nature of an explosion is necessary we are afraid to both wake-up and shake-up the people interested.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in the Power Field.

Montreal Stationary Engineers want a by-law changed so that men in charge of gasoline engines will require a license. Hamilton and Toronto are also contemplating changes in by-laws respecting stationary engineers.

North Bay, No. 35, C.A.S.E.—We are in receipt of a report from this lodge which indicates that it has gone out of existence. Considerable effort was expended, we understand, in combatting the tendency to lapse, and while there is no immediate prospect of its resurrection, we hope to hear of its taking a place again on a early date in the C. A. S. E. organization.

Hamilton, No. 2, C.A.S.E. held their regular meeting on Monday, October 27, in their hall, James Street North. There was a large attendance of members. The Executive President, S. Cosford, London, Ont., and Past Executive Secretary, W. A. Crockett, were present, and gave interesting talks to the members. President Lackie and Messrs Sweet and Ellis read papers illustrated by drawings on the blackboard.

Ottawa, No. 7, C.A.S.E.—At the last regular meeting of Ottawa, No. 7, C.A.S.E. held in the Union St. Joseph Hall, 325 Dalhousie Street, it was decided to inaugurate classes for the education and instruction of the members relative to higher degree accomplishment in the pursuit of their calling of practical stationary steam engineering, and to invite all engineers, connected with the C.A.S.E. or otherwise, to avail themselves of the opportunity afforded. Classes will be held on the first and third Friday of each month, following the completion of the regular business session of the Lodge on these nights. In addition to the above, a series of lectures will be given each month in the lecture hall of the Carnegie Library, on such subjects as steam appliances, steam generators, internal combustion engines, electrical generators, steam heating and ventilation, etc. Bro. A. Campbell is class instructor in mathematics; Brother A. Kastella is instructor in the subjects of steam and the steam engine; Bro. F. Murrell in refrigeration; Bro. F. Roberts in steam heating; Bro. G. I. Scott on steam turbines; and Bro. A. Campbell on steam boilers. Since the reorganization of this Lodge last June, rapid strides have been made, and a large accession to the membership falls to be recorded.

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Conductor—Robert Dyson, Guelph, Ont.

Port Arthur, No. 29, C.A.S.E.—This branch held an "At Home" in their lodge room in October, the occasion marking the last meeting before moving to new quarters. The members, wives and lady friends were present in large numbers. Bro. Nagle was in the chair. A splendid programme of vocal and instrumental music was rendered, after which dancing was carried on until midnight, when the members took supper, which had been provided by the ladies. Dancing was then continued until 3 a.m. This was without doubt the most successful social ever held by this lodge. Some time ago a committee, composed of Bros. Wilson, Ibey and Miller, was appointed to secure a new lodge room, as in the old building only two meetings could be held each month, and this did not give sufficient opportunity for educational work. Furniture has been purchased for the new rooms, which are sublet to other societies when not used by the No. 29. A charter is expected soon for the Ladies' Auxiliary, recently organized. Fred Nagle is president of this flourishing branch of the C.A.S.E.

Mather & Platt, Ltd., Manchester, Eng., have sent a copy of a new catalogue No. 50, describing their turbine pumps. A brief history is given of the Mather pump, together with a description of the various types. Views are shown of high lift pumps, pumps working in mine shafts, and other installations. The catalogue also contains some efficiency curves and tables giving output and principal dimensions of various sizes. The Canadian Allis-Chalmers, Ltd., Toronto, have exclusive manufacturing rights for this pump, and will be glad to send copies of this catalogue to interested readers.

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THE OPERATORS' VIEWPOINT

Devoted to brief descriptive article contributions covering ideas and experiences pertaining to power plant practice and operation. We pay for accepted material.

SPLASH LUBRICATION.

By H. Westwood.

ONE noticeable feature in the operation of gas engines is that the vertical engine running with the splash system consumes more oil than the hand oiled horizontal engine of the same horse power. One spot of oil at the right place is worth a quart at the wrong. In the case of the hand-oiled horizontal engine, if the cups are feeding too fast they can easily be adjusted, but, in the case of the vertical type-splash system you must keep the oil to a certain level in the crank case and let the connecting rod bolts throw all the oil that will hold to them. It is a common thing to find a 100-h.p. engine on the splash system consuming 7 to 8 gals. of oil in 24 hours, while 1 gal. will easily lubricate the hand oiled engine. I had a case some time ago of a vertical engine which consumed 5 gals. in eleven hours.

A representative of a well-known oil firm came along and said the oil I was using was no good, and if I would use his oil it would only take 1 gal. per day. This new oil was worth three times as much in price as the oil I was using; however, I decided to try two barrels. The crank case was cleaned out and 35 gals. of the new oil put in, but in order to keep the case level the same, I had to use as much of the high-priced oil as I did of the low.

I decided later to lower the oil in the crank case, and thus stop the engine throwing so much up into the cylinders. I altered the oil level so that the connecting rod bolts did not touch the oil at all. Four 1½ in. bolts and 4 nuts and cotter pins can pick up a lot of oil.

I took out the two back bolts, and drilled and tapped a hole for a ½ in. stud. I bent the stud ½ in. over at the bottom and flattened it out for an oil slinger. I then screwed the stud into the connecting rod bolt and locked it with a lock nut. The stud dipped into the oil 1½ inches. When the engine was started up, I took good care to see that the cylinders were not running hot, and, after five hours' run shut down and found the cylinder walls well oiled. This move cut the oil down to 1 gal. per day, but one half gal. in ten hours on a bearing 8 in. x 7 in. was not enough, so something had to be done to use the oil from the crank case.

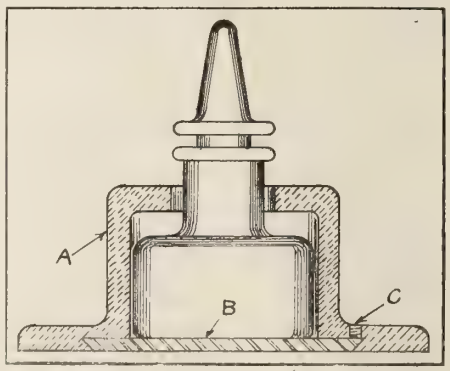
I got a small pump which had been used to circulate the jacket water on an automobile. It was 1 in. bore by 1¾ in. stroke. I attached this to the side of the crank case and drove it by a ⅝ in. Con. rod attached to the end of the exhaust cam shaft. I made the pump discharge into a two gallon tank located on the back of the engine between the two cylinders and piped the oil to run through two 1 quart sight feed oil cups, one on each side main bearing, also a pipe to the centre bearing in the crank case. The oil then ran in a steady stream all the time the engine was running.

This method supplied the bearings with about 10 gals. of oil an hour, where as before they only received 1 gal. in ten hours. The wear of the bearings was not only reduced, but the engine ran smoother, and cut down the oil expense by $300 a year.

INK BOTTLE HOLDER.

By E. W. Tate.

THE illustration shows a device used in connection with a draftsman's ink bottle, to prevent the latter being upset. The cylindrical shaped holder



INK BOTTLE HOLDER.

(A) was, in the experience of the writer, made of bronze, a material in every respect highly suitable and satisfactory. A steel plate retaining slide (B) is held in place, after the bottle is inserted, by means of the friction screw (C).

DATA ON ROPE SHEAVES.

By H. Womersley.

ROPE sheaves are an important factor in mechanical engineering, and much time is wasted, owing to men in charge not knowing the fundamental principles involved in their application. I have seen men sent out to work on jobs after the most haphazard fashion. The weight to be lifted, size of blocks, and the power required being never considered. Sometimes more men are sent on a job than are necessary, causing additional expense; while at other times too few are sent. Varied are the arrangements which can be made and utilized for lifting weights with rope and tackle, and, therefore, I will state the principles relative to rope sheaves as applied to mechanical power, transmission, so that the reader can work out the different problems which crop up when following an engineering occupation.

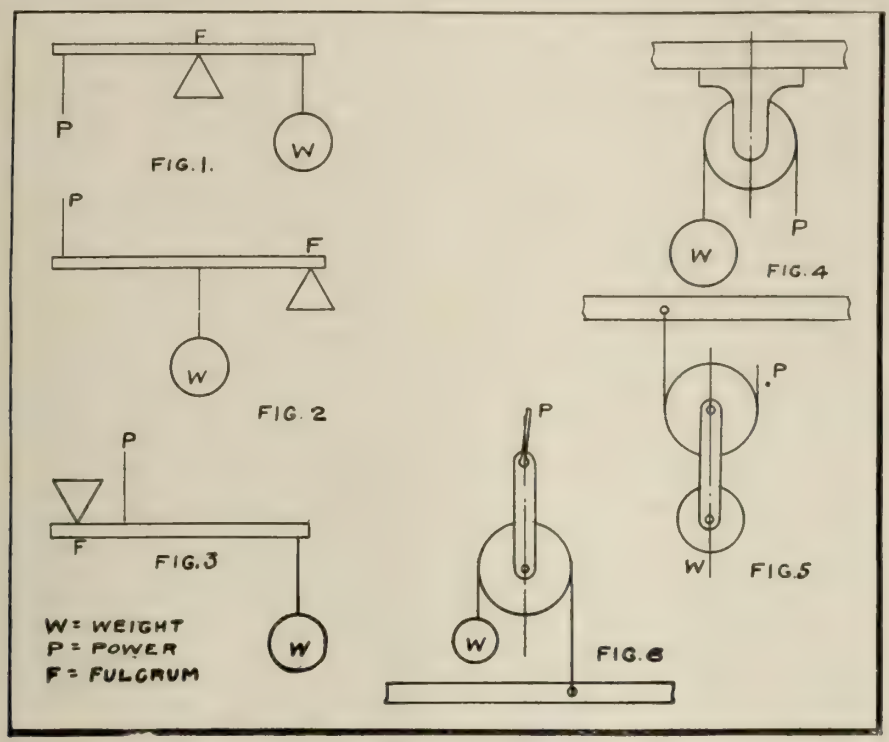
Mechanical powers are certain simple mechanical arrangements whereby weights may be raised or resistance overcome through the exertion of less power than is necessary without them. Levers come under the same class as rope sheaves; therefore, a few words on levers previous to dealing with the former will enable the reader to better follow the subject.

Levers are of three classes. In a lever of the first order the fulcrum is between the power and the resistance, as shown in Fig. 1. In a lever of the second order, the resistance is between the power and the fulcrum, as shown in Fig. 2, while in a lever of the third order, the power is between the fulcrum and the resistance, as shown in Fig. 3.

The rope sheaf consists of a wheel over which a rope is passed to transmit the force applied to the cord in another direction. There are two kinds of sheaves, one turning on fixed centres, the other turning on traversing centres. The fixed sheaf, Fig. 4, acts like a lever of the first order. It affords no mechanical advantage, and merely changes the direction of the force, affording greater facilities in the application of force, as it is easier to pull downwards

than upwards. In this class, the power is equal to the weight to be raised.

The movable sheaf, Fig. 5, acts like a lever of the second order. One end of the rope is suspended to a beam, as a fulcrum, and the weight is attached to the axis of the pulley. This type of sheaf doubles the power at the expense of speed, the product of the power by the diameter of the pulley being equal to the product of the weight by the radius of the pulley.



DATA ON ROPE SHEAVES.

A movable sheaf acting as a lever of the third order is shown in Fig. 6. One end of the cord is fixed to the floor, and the weight is attached to the other end, the power being applied to the axis. The power is equal to twice the weight, and the product of the power by the radius of the pulley is equal to the product of the weight by diameter of pulley. In Fig. 7 the power is equal to one-half the weight.

A combination of movable sheaves with separate and parallel cords is shown in Fig. 8. Each of them reduces the resistance to the extent of one-half; dividing and sub-dividing the weight successively by two as many times as there are movable pulleys, and the weight may be found by multiplying the power successively by two as many times as there are movable pulleys. Blocks and tackle of the usual kind are shown in Fig. 9. In this system of fast and loose pulleys there is one fixed and one movable block, and a single continuous cord, which is passed over the moveable and fixed pulleys in succession.

Rules and Examples.

I will give a few rules and examples bearing on how to find the power to lift a weight. and on how to find weight that will be balanced by a given power.

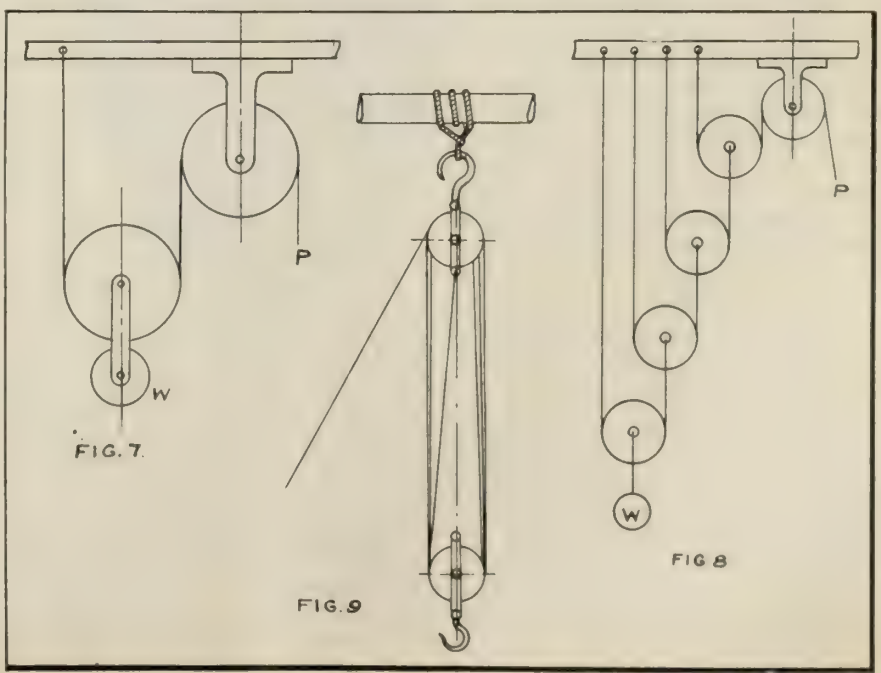
To find the power: Divide the weight to be raised by the number of cords leading to, from, or attached to the lower block, and the quotient is the power required to produce equilibrium, provided friction did not exist. When the fixed end of the rope is attached to the fixed block, the power may be found by dividing the weight by twice the movable pulleys, and when the fixed end of the rope is attached to the movable block, the power may be found by dividing the weight by twice the number of movable pulleys plus one.

To find number of sheaves or cords: Divide the weight to be raised by the power to be applied, then the quotient is the number of sheaves in, or cords attached to the rising block.

Example 1.—What power is required to raise a weight 3,000 lbs. by means of a four and five-sheaved block and tackle, the four sheave being the movable block. Necessarily, there are nine cords leading to and from the rising block, consequently $\frac{3{,}000}{9} = 333\ 1\text{-}3$ lbs. power required.

Example 2.—Suppose I have to raise a weight of 4,256 lbs. with power of 500 lbs., what kind of block and tackle should I use? Dividing $\frac{4256}{500} = 8.51$ cords, hence there must be four sheaves or 9 cords in the rising block.

Rule 3.—To find the weight that will be balanced by a given power. When the rope is attached to fixed block, multiply the power by twice the number of movable pulleys, and when the rope is attached to the movable block, multiply the power by twice the number of movable pulleys plus one.



DATA ON ROPE SHEAVES.

PACKINGS FOR FEED WATER PUMPS.

By T. M.

PERHAPS no other part of a power plant equipment should receive more careful attention than the boiler feed pump. The engineer has learned the vital importance of keeping this particular pump in as near perfect running order as possible and bends every effort towards this end. The conditions under which it operates are admittedly severe, and its failure at the critical moment

may often be traced to design, material and workmanship, or to its accessories, such as oils, packings, fittings, etc.

The law of supply and demand pretty well regulates the design and construction of feed water pumps, and the reputable pump manufacturers are practically agreed upon certain standards which keep their records surprisingly free from complaints. The durability and successful performance of these specialties is usually the result of proper selection on the part of the engineer.

The ever varying conditions make the proper selection of packings for pumps a very important matter.

The feed pump piston packing is continually subjected to three conditions—high temperature, high pressure and water. Many meritorious packings will withstand one and often two of these conditions, but the skilled engineer will think carefully before adopting as a standard the packing best suited for all three of the conditions mentioned, and since the actual cost of a high grade packing required each time the pump is repacked will usually not exceed an average of more than $1.25, it is needless to observe that his judgment should not, and in most cases is not, influenced by the question of first cost. He knows that his superiors demand security, and his efforts are directed to that end.

As the opinions of professional men often differ sometimes widely on given subjects, just so will they differ among engineers as regards the type and construction of packing for this purpose, but well informed engineers all agree that in order to give them permanent security, the packing for this purpose should unquestionably be made of the highest grade materials obtainable, manufactured with care and precision and able to withstand the above mentioned conditions, viz., high temperature, high pressure and water.

It is not the intention of the writer to specifically mention in this article the names of packings which are most highly regarded for this purpose; but he will be pleased, from time to time, to make any suggestions or answer inquiries from our readers pertaining to this line.

EFFECT OF BOILER GRAPHITE.

By C. T. R.

EVERYONE knows that to some extent all waters used for feeding steam boilers contain impurities, either in suspension or in solution. Everyone knows, too, just what happens when the impurities collect on the boiler shell and tubes in the form of scale or soft mud, in sufficient quantities to affect the steaming properties or to even seriously imperil the safety of the boiler. The explosions about which we read so frequently are nearly always caused by the failure of a scale-clogged tube, or a scale-incrusted plate that has warped to the point of rupture, or to an unsuspected crack in the shell that had been concealed by scale. The fight against scale is being stubbornly waged.

Effects of Scale.

The effect of scale in a boiler ordinarily is to reduce both its steam-generating capacity and its economy, since scale is not a good conductor of heat and, therefore, diminishes the transmission of heat through the boiler plates and tubes. Scale is also highly dangerous, for whenever it accumulates to any great extent at a part of the shell exposed to the flame or to very hot gases, it prevents the cooling action of the water from protecting the metal against burning. The plates frequently become overheated and weaken so as to "bag," crack, and cause an explosion.

Scale Removal.

Since nothing has been found to absolutely prevent the formation of scale, the only logical thing is to employ some means to easily and safely remove the scale that does form. Flake graphite has been used for this purpose for many years, and with gratifying results. The action of graphite is not chemical; it does not dissolve the scale, nor does it attack the metal; neither is it affected by acids in the water or by the heat generated in the boiler. The particles of graphite simply work into the minute cracks existing in the old, hard scale and gradually penetrate between the scale and the metal. The scale thus loosened may be rapped off or removed otherwise without trouble.

It must be understood that if the scale is very hard and thick it may require as long as three or four months for the graphite to loosen it, but once removed, scale can never adhere firmly to the metal again as long as the graphite treatment is continued. Graphite also becomes thoroughly intermixed with new scale as it forms, rendering it soft and crumbly. In short, graphite makes boiler cleaning positive and easy.

It's use minimizes the time and power lost while cleaning; increases efficiency of heating surfaces; reduces fuel consumption; minimizes repairs; improves operation of feed pumps and water meter, and prolongs the life of boilers.

The action of graphite is purely mechanical. It may be used in any feed water and in any type of boiler. It will not evaporate or dissolve. It cannot cause "foaming," nor under normal conditions can it pass from the boiler with the steam and thereby render it unfit for industrial purposes; for this reason, it finds special favor in ice plants, laundries, breweries, sugar refineries, canneries, etc.

Forms of Graphite.

It is generally conceded that graphite is a satisfactory agency for the successful removal and prevention of boiler scale, but careful consideration should be given the grade of graphite best adapted for the purpose. Graphite as found the world over, is divided into two general glasses only—flake or crystalline, and amorphous. Amorphous graphite is valuable for certain purposes, such as foundry facings, stove polish, etc., where its properties of balling-up or sticking together in masses is not objectionable. It is a fact, however, that this form of graphite, due to the physical characteristics of the particles to a certain extent forms into pasty or mud-like masses in the presence of water in a boiler, and settles on the plates and tubes. On the other hand, experience has shown that the finely pulverized thin, flake variety of graphite will be distributed evenly on the surfaces of the shells and tubes and become more permanently attached to the metal than the amorphous graphite. This means that, pound for pound, flake graphite will give at least twice the service of the other. In other words, every particle of finely pulverized, thin, flake graphite is a scale reducing particle.

Both amorphous and flake graphite are employed, but investigation shows that those who manufacture and sell both grades, recommend the finely pulverized material in preference to the amorphous, although the margin of profit is approximately the same on both.

POWER PLANT TROUBLES.

By J. E. N.

"THERE is continual trouble in our power plant," said a manufacturer, "and I am at a loss to know what to do to get things going right." "That's an easy one to answer," said his friend; "remove the cause."

In many large power plants, there is often continual trouble; sometimes it is the fault of the owner, sometimes otherwise, and for the benefit of the former I will make a few suggestions, based upon knowledge gained from personal observation and experience.

Have three shifts of eight hours each, instead of the usual 12-hour shifts, and engineers would appreciate being given the same working hours as other mechanics.

If your engineers put in daily reports, get the necessary printed forms, even for moderately small plants, as it means a considerable saving of time to the engineers if they have to write up a com-

plete report; besides, the chances are that some of the most important items will be side-tracked. It is a great help to the engineer if he has only to fill in the figures. If a blank sheet is used, the report is more than likely to be so incomplete as to be of little real value. In large plants, of course, the printed forms for the different departments are always used.

Plant owners, managers, and chiefs should understand that an occasional word of commendation goes a long way towards making more efficient and satisfied men and, therefore, less trouble. It is not always dollars and cents that count, for a little appreciation shown by the boss to the firemen, cleaners and other employees is a sure trouble chaser, no matter how faithful this class of power plant worker be.

Do not imagine that by refusing to install labor saving appliances and compelling the men to work early and late, that you are saving money and trouble. Oh no, just the opposite. You may have good men and they may do their best, but good appliances will do things better if they get proper care.

The water should go through a purifier before it goes into the boiler, a proceeding which will save your men some work, and incidentally increase the power of your heretofore partly scaled boilers, on the same amount of or less fuel.

A wonderful trouble eliminator is the free use of recording instruments for gases, water, steam, vacuum, draft, electric power, etc. They help the chief and often prevent trouble among the staff by showing up the careless or incompetent man. They will show where losses occur, and their advantages are altogether too numerous to mention.

It is not always the chief or his men who make trouble in the plant. Sometimes the owner, manager, or superintendent is the nigger on the fence, by giving orders to the men over the chief's head or interfering in other ways.

There are other trouble makers, but the foregoing corrected, will make those that remain more easily solved.

WASTEFUL COMBUSTION—THE SMOKE NUISANCE.

THERE is an aspect of this question of wasteful combustion and the smoke nuisance, writes a correspondent of the "Manchester Guardian," which continually causes wonder to those who come into close touch with the management of mills and works; it is the extraordinary absence of reasonably scientific methods in the average boiler house. The most up-to-date and exact principles are adopted and enforced in the engine-house and through all the different operations of production, but they so very often stop short at the steam generation equipment.

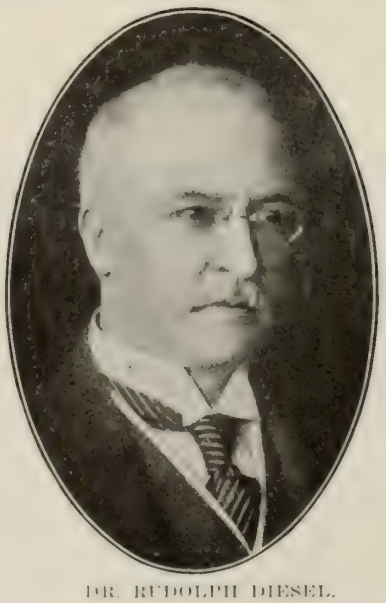
This is all the more remarkable when one considers how largely the item of coal at to-day's high price must enter into the cost of production, and one would, therefore, think that the most strenuous efforts would be made by every mill-owner to obtain perfect combustion and the most economical burning of his coal.

It is often the case, however, that a boiler-house is manned by stokers who are stokers only in name—mere laborers, who throw coal on anyhow, and whose only object is to keep up the head of steam.

Stoking is a fine art, and good hand-firing is probably as economical and produces as little smoke as any mechanical apparatus yet on the market. If our factory and plant owners could be influenced to put highly skilled and well-paid stokers in their boiler-houses, and relieve them of all other duties, such as oiling or attention to engines, they would do much to minimize the smoke evil so far as industrial smoke is concerned.

DR. RUDOLPH DIESEL.

DR. RUDOLPH DIESEL, whose disappearance was chronicled recently, was born in Paris in 1858, and although of German parentage, commenced his education in France. At the age of 13,



DR. RUDOLPH DIESEL.

he was sent to Augsburg and later to Munich. After serving for some time as assistant to Prof. von. Linde, he spent a short time in practical work in Winterthur with Sulzer Bros., and was afterwards appointed manager of the Paris firm for the manufacture of the Von Linde refrigerating machinery.

Ever since his early days at Augsburg and Munich, his main ambition, possibly an obsession, was to discover a prime mover with a much higher thermal efficiency than the steam engine. He designed an engine, and, in 1893, Messrs. Krupp and the Augsburg-Nuremberg Co. gave him financial assistance for its construction on the lines he had designed. This was a failure, indeed, it exploded and nearly killed Dr. Diesel, but it showed at any rate that pure air could be compressed to such a degree that it would ignite oil fuel. A second engine was more of a success, but was not reliable, and was, moreover, attended with much danger in the working, but after several experiments with it, another was constructed by the Augsburg Company in 1897, and this proved to be successful.

Since then many improvements have been effected. The first Diesel engine installed in a ship was built in 1903 by Adrien Bochet and Frederic Dyckhoff, this being of 20 h.p. and having two pistons working in opposite directions in one cylinder on the 4-stroke cycle. The patents for Great Britain are owned by the Diesel Engine Co., which is now merged into the Consolidated Engine Manufacturers, Ltd.

The circumstances of the tragic disappearance of this great inventor are too well known to be reiterated, but if it be true that he is lost to us for ever—and we are reluctantly compelled to admit the great probability—the world has been deprived of a great inventor whose perseverance and tenacity of purpose won for him the admiration of all who know the story of his early failures.

READERS' QUERIES.

Leaky Oil Ring Bearing.—In reply to the oil ring bearing query of George Munro, on page 281 of the October issue of The Power House, I am of opinion that the bearing is worn, leaving, thereby, too much play, and the only remedy is to have a new one. A somewhat similar case arose in my own experience, and was treated as above advised, with the result that the trouble disappeared.—R. W. Philip.

* * *

Raising Steam Electrically.—I have a battery of eight return tubular boilers under my charge, each unit of which approximates a 200 h.p. rating. Coal is the fuel we use and the steam generated is employed for drying purposes only. Our power requirements are met by a hydro-electric installation which produces at a very low cost and leaves us with 750 h.p. to spare. I would like to know if it is possible to use this excess electrical power for steam generation purposes in one or more of our boilers, and to have some data covering equipment details of any such arrangement at present installed.—T. P. Matthews.

Practical Questions and Answers for Engineers

The present series of Questions and Answers will be departmental in their scope, it being our intention during the course of publication to have an equal number appear in each issue relative to two sections of power plant operation and practice. Comment and inquiry are invited.

Steam Engine.

Question.—In a slide valve engine, how is the steam usually admitted to the cylinder?

Answer.—Over the ends of the valve.

* * *

Question.—In a piston valve engine how is the steam generally admitted to the cylinder?

Answer.—Either over the ends or in the centre of the valve.

* * *

Question.—With the slide valve, where does the exhaust get out?

Answer.—At the centre of the valve.

* * *

Question.—With the piston valve, where does the exhaust get out?

Answer.—At the centre or over the ends of the valve, depending on how admission is made.

* * *

Question.—What is the relation of the eccentric to that of the crank on a slide valve engine?

Answer.—90 degrees plus the lap and lead, in advance of the crank.

* * *

Question.—What is the relation of the eccentric to that of the crank on a piston valve engine?

Answer.—If steam is admitted over the ends of the valve it is 90 degrees plus the lap and lead in advance of the crank. If steam is admitted at the centre of the valve, it is 90 degrees less the lap and lead, behind the crank.

* * *

Question.— Does an injector require the same pressure for its operation when lifting water, as when the water flows to it under a head or pressure?

Answer. — It requires more pressure when the water has to be lifted, and this will vary to some extent with the height of lift.

* * *

Question.—In a ball governor when in operation on a steam engine, what are the opposing forces at work?

Answer. — Centrifugal force due to the revolving of the balls, which tends to make them pull apart from their pivot, and the force of gravity which tends to keep them in the position occupied when the governor and engine are at rest.

* * *

Question.—What purpose does a flywheel serve outside of its utility for a belt, rope or chain drive, when attached to the crank shaft of a steam engine?

Answer.—It stores up the energy developed in the engine cylinder during the period in which the steam is performing its work, and gives same out again when the steam has been cut-off, thereby enabling the engine to maintain a steady and uniform speed, and obviate any jar when the crank is passing the centres.

* * *

Boiler Feed.

Question.—Feed water heaters are of two well known types—the open and closed. Give description of the constructional features of each.

Answer.—In the open type heater, the feed water is brought into direct contact with the exhaust steam; being afterwards drawn off by the feed pump and delivered to the boiler. On account of the water being of a high temperature and vaporous, the outlet from the heater should drain or fall towards the pump suction. In the closed type heater, the feed water is delivered under pressure through tubes around which the exhaust steam plays in an enclosed chamber; the heat from the steam being transmitted through the thin tube walls to the water. With the closed type heater, the water passes through the pump cold, and as a consequence, calls for less care in pump chamber design as well as relative position of heater and pump in installation.

* * *

Question.—Explain the action of an injector, when feeding a boiler.

Answer.—At first sight, the action of an injector seems to be a paradox, since water is delivered into the boiler against a pressure equal to or greater than that of the steam operating the injector. The explanation is as follows. The velocity of an issuing jet of steam is many times greater than that of a jet of water issuing under the same pressure, and, if steam, while issuing from a boiler, be condensed, but not reduced in velocity to that of water issuing under the same pressure, it is then capable of overcoming the pressure of the water in its own boiler. This is exactly what takes place in the injector. The steam on entering, passes through the cones and is condensed on coming into contact with the feed water, without losing its velocity, further than that due to friction in the passages. The vacuum formed by the condensation of the steam causes more water to flow into the injector, and this feed water is carried on by the force of the condensed steam jet into the boiler. The velocity of the steam jet is much reduced by imparting a high velocity to the feed water, but as it is not reduced nearly so low as that of a jet of water issuing under the same pressure, sufficient momentum is imparted to the feed water to lift the boiler check valve.

Electrical.

Question.—What is the volt?

Answer.—The volt is the practical unit of electro-motive force and represents power or pressure.

* * *

Question.—What is the ampere?

Answer.—The ampere is the practical unit of electric current, and is of volume such as is produced by the pressure of one volt flowing through a conductor against a resistance of one ohm.

* * *

Question.—We hear a great deal about static electricity and dynamic electricity, give a brief definition of both.

Answer.—Static electricity is that produced by friction; dynamic electricity that produced by a dynamo and known as current electricity.

* * *

Question.—How would you determine whether the armature of your machine was running hot or otherwise?

Answer.—Place your hand in the current of air which is thrown out by reason of its revolution.

* * *

Question.—How would you determine the pull in pounds of a motor armature at one foot radius?

Answer.—Multiply the number of wires on the outer surface of the armature by the amperes of armature current and by the total number of maxwells of magnetic flux passing through the armature, and divide their product by 852,000,000.

* * *

Question.—How may we determine the electromotive force in volts developed in the armature of a motor or generator.

Answer.—By a record of the number of wires on the outer surface, of the number of maxwells of magnetic flux that pass through the armature and the revolutions per second. In the calculation for 2 pole armatures, multiply the number of wires on the outer surface of the armature by the maxwells of magnetic flux, and by the revolutions per second, and divide their product by 100,000,000. For multipolar armatures with series or wave winding, use same rule, making the flux equal to the sum of the fluxes issuing from all the positive poles. For multipolar armatures with lap or parallel winding, use same rule but take the flux issuing from one pole only.

PROGRESS IN NEW EQUIPMENT

There is here provided in compact form a monthly compendium of the power plant manufacturers' achievements.

WATERWHEEL GENERATORS.

WATERWHEEL generators have recently been built to conform with the rapid development of hydraulic power for driving electric generators. The increased demands for such service require almost infinite combinations of capacity and speed range. Refinement in the design of both generators and waterwheels have made these changes possible; the successful operation of many high voltage transmission lines and the ever-increasing demand for power, all aid materially in the utilization of many water powers heretofore considered either impracticable or inaccessible.

Two types of waterwheel generators are built—horizontal and vertical, depending upon the local conditions in each case, and these, of almost any practical capacity or speed for installation in the smallest isolated plant or the largest hydro-electric generating station have been furnished by the Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.,

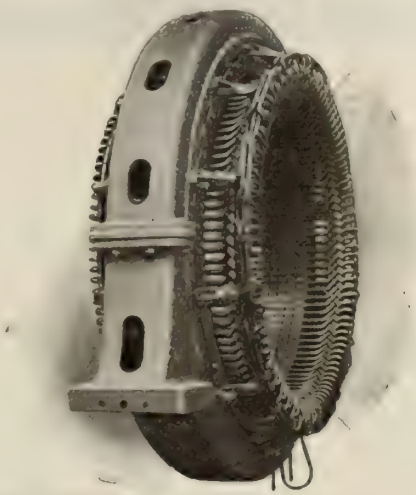
Horizontal Type.

The standard horizontal unit is of the two-bearing, coupled type construction; that is, the generator includes shaft, two-bearings and a bedplate usually designed to allow for sliding the stator to one side in case ready access to either the stationary or rotating winding is desired.

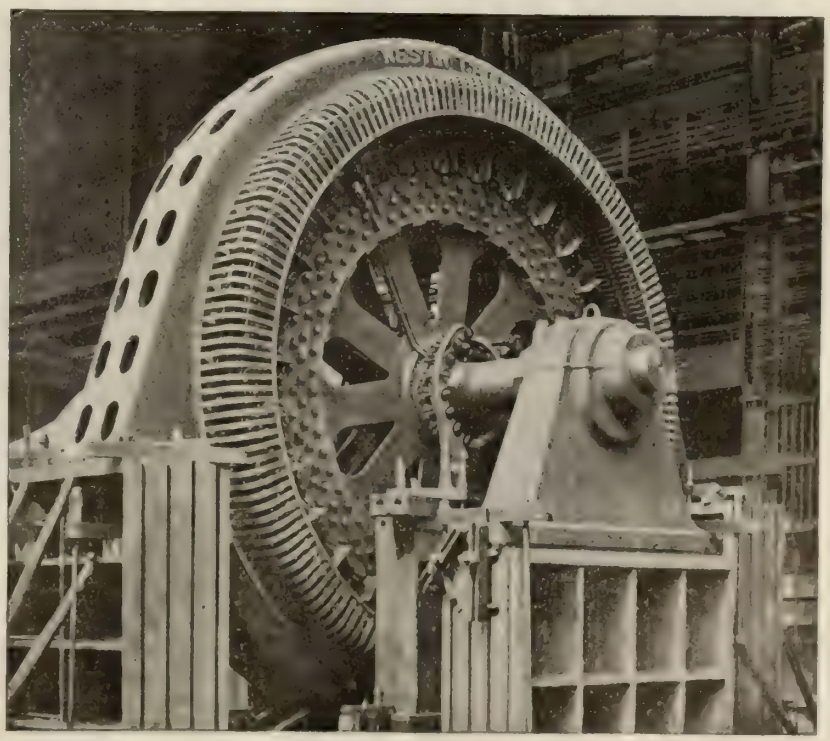
The stationary frame is a strong, rigid iron casting, into which soft steel laminations are dove-tailed and securely fastened..

Ventilating ducts are spaced at frequent intervals across the face of the armature punchings, allowing for perfect ventilation to all parts of the active material. Form wound, interchangeable armature coils fit into parallel open slots punched in these laminations, and the coils are held firmly in place by means of fibre wedges. The coils are insulated and impregnated with fabrics

ARMATURE STRUCTURE FOR 1,000 K.V.A., 13,800 VOLT., 60 CYCLE UNIT.



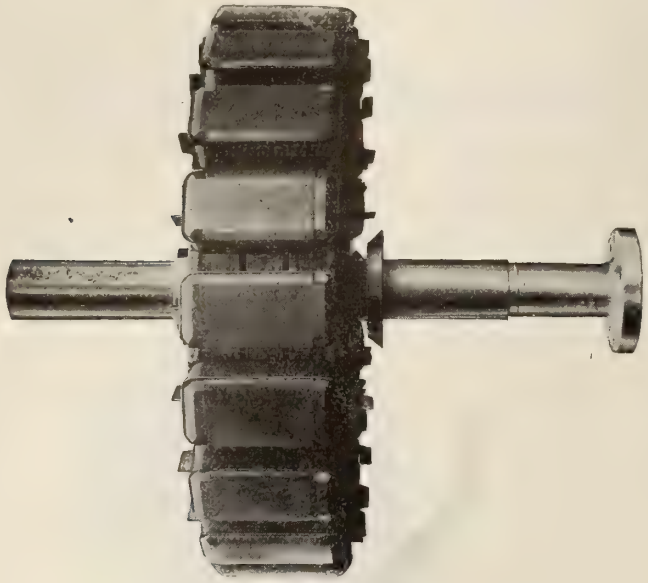
SHOWING METHOD OF SLIDING STATOR TO ONE SIDE.



9,375 K.V.A., 6,600 VOLT UNIT IN SHOP TESTING RIG.

and compounds of high insulating qualities.

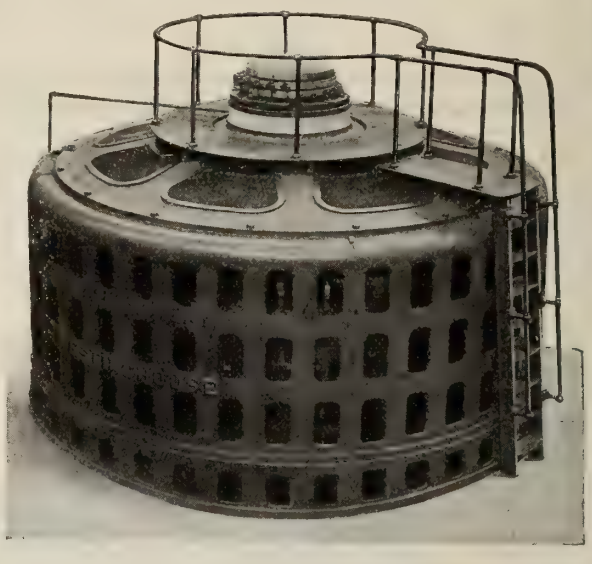
No single type of construction will meet the varied requirements in rotor design, therefore, several well tested methods are employed. When comparatively low peripheral speeds are encountered, a cast-iron spider with bolted-on, or dove-tailed poles, is usually employed. For higher speeds, cast steel or steel plate construction may be used. In the case of very large relatively high speed machines, the difficulty of securing perfect castings may lead to the well-proven laminated rim structure.



STEEL PLATE ROTOR

All field poles are made of thin steel laminations riveted together with overhanging pole tips provided to support the field windings. Field coils are wound of heavy copper strap on edge, insulated in such a way that each individual turn is exposed to the ventilating air, and thus perfect radiation results. The coil is securely fastened between the rotating spider and the tips of the field poles by heavy coil supports.

All parts are inspected during each step in the process of manufacture, and before the succeeding operation is started. When completed, the machine is tested under conditions, as nearly identical as possible, to those which its future service will demand.



12,500 K.V.A., 6,600 VOLT, 50 CYCLE GENERATOR COMPLETE.

LAMINATED RIM ROTOR WITHOUT FIELD POLES.

LAMINATED RIM ROTOR WITHOUT FIELD POLES.

Vertical Type.

Westinghouse standard practice recommends that the generator be fitted with two guide bearings which are supported by brackets fastened to the stator frame; also, a bedplate or pad on which the stationary part rests. The roller or thrust bearings which support the weight of the revolving part may be mounted on top of the generator frame between generator and turbine, or underneath the turbine. In case it is mounted on top of the generator frame, this frame must of course be made heavier and more expensive, than in cases where it has only to support the stator punchings, winding and guide bearings. Wherever placed, this bearing usually supports not only the rotor of the generator, but also the turbine runner, and in addition, takes care of any unbalanced water thrust. A rigid cast iron frame into which soft steel laminations are securely dove-tailed, forms the basis of the stator.

Form wound, interchangeable arma-

ture coils are held in open slots by means of fibre wedges. The coils are vacuum dried and impregnated before the outside insulation is applied. This outside insulation consists of wrappings of paper and mica on the straight portions of the coils which lie in the slots, and servings of treated cloth over the V-shaped coil ends. After the outside insulation is applied, the coils are treated with an insulating varnish which renders them moisture and oil-proof. An insulating cell is provided in each armature slot to prevent abrasion of the coil, and a fibre wedge holds coil and cell firmly in position.

In case of failure of a waterwheel governor to act, the rotating part of both waterwheel and generator are subjected to unusual stresses, due to the overspeeding of these parts. The rotors here illustrated are designed for the maximum obtainable speeds which result in such instances. These overspeeds vary from 50 to 100 per cent. Due to the wide range of speeds encountered, no one type of rotor construction will give ideal results. There are several designs of rotors, each one particularly well adapted for the requirements for which it is used. Comparatively low peripheral speeds may permit the use of a cast-iron spider with either bolted-on or dove-tailed poles. A higher speed generator may demand an entirely different construction. For such work, cast steel or rolled steel plates are often employed. In case of very large machines, it may be difficult to obtain perfect castings, and here the well proven laminated rim may be employed.

Field coils are ordinarily wound with heavy copper strap on edge and insulated between turns with asbestos. This construction is particularly well adapted to give perfect radiating qualities, and, because of the heavy strap used, is practically indestructible. The coils are securely fastened between the rotating spider and projecting tips of the field poles by heavy coil supports.

REPORT ON BOILER EXPLOSION AT COLLINGWOOD, ONT.

T. J. MAIN, Provincial Boiler Inspector, in his report to D. M. Medcalf, Chief Boiler Inspector, Province of Ontario, says:

On September 25th, by your instructions, I proceeded to Collingwood, Ont., to inspect a boiler built by the Sawyer Massey Co., and owned by Blackstock Bros., and situated at their farm about two and a half miles from Collingwood. Blackstock Bros. were endeavoring to sell the boiler and engine to Schell Bros., and were running a test with the steam gauge standing at 80 lbs. per square inch and with 3 inches of water showing in the glass when the boiler exploded, killing Edward Blackstock, while his brother, Neil, received very serious injuries. The Schell Bros. were not seriously hurt.

Boiler Features.

The outfit is known as a threshing engine and boiler mounted on wheels. The boiler is 28 in. diameter, and contains 36 tubes 2 in. diameter by 70 in. long. The shell is 3-16 in. plate; the heads, wagon top and furnace ¼ in. plate; the front head and furnace tube sheet 5-16 in. and the foundation ring of cast iron 2 in. by 2 in., and flange 1 in. by ½ in. The furnace was 23½ in. by 32 in. inside. The boiler was made of steel throughout; the riveting of longt. seams ⅝ in. rivets by 2¼ in. pitch; circum. seams ⅝ in. rivets by 1⅞ in. pitch. The screw stays were ¾ in. diameter by 12 threads per inch.

All parts of the furnace and crown sheets were in fair condition. The shell of boiler was made in two courses, and the rupture started on the front end of the centre course just below the longt. seam. The longt. seams are about ten inches below the centre line of boiler, and the lap joints look down. They are made that way so that when the machine is out in the weather the rain or water will run off without laying on and corroding the seams.

It would appear that the caulking on this seam had been defective, and leaked slightly for some time, as the shell plate at this point had corroded until it was only .047 or 3-64 in. thick at the front end of this seam. At the other end of this seam, the thickness is .104, plainly showing that the seam had been leaking the whole length. When the longt. seam let go, the force of the explosion was downward, the second course shearing off at the line of the first course, just back of the riveted seam. The boiler and engine then scattered over a radius of 100 feet.

The safety valve was free and appeared in good working order. There was no slope to the water gauge. The injector (Penberthy) is practically new. They were carrying 80 lbs. pressure per square inch when the explosion occurred. When they had stopped using the boiler about one year ago, they had been carrying 120 lbs. pressure. At its best, when new, according to our regulations, it was never good for more than 100 lbs. pressure:

$$\frac{2\times.1875\times60000\times.69}{28\times5.5} = 100 \text{ lbs. W.P.}$$

and when the boiler explosion took place it was not good for more than 25 lbs. W.P.

$$B\ \frac{2\times.047\times60000\times.69}{28\times5.5} = 25 \text{ lbs. W.P.}$$

The place where the rupture took place was easy of access, and if the boiler had been under inspection, the corrosion could easily have been detected, an explosion prevented, and lives saved; in fact, boilers of this class, with such light plate, could not be allowed under present Regulations.

When it is realized that boilers of this class do not come under the present Regulations, and that manufacturers of this class of boiler are still building them of the same material, and further, that there are hundreds of these boilers in Ontario in no better condition than the one that exploded, and that it is not by any good management of the owners that they hold together, then something ought to be done to save the people from themselves.

LARGE CONTRACTS FOR WATER POWER PLANTS.

IN connection with the new enterprises of Dr. F. S. Pearson in Barcelona, Spain, known under the name of The Barcelona Traction Co., and in which considerable Canadian money is invested, the well known Swiss turbine builders, Escher Wyss & Co., have secured large contracts for the supply of water wheels and pipe lines. Besides an auxiliary plant of 4,000 h.p., which was delivered and erected in record time, four large installations are being equipped by Escher Wyss & Co. Three of these utilize water from the River Ebro. The first installation comprises five units of 16,000 h.p., each under a head of 140 feet, and is nearing completion. For the second and third the turbines are well under way in the works, and are being rushed to completion. These installations comprise in one case four units, each of 15,000 h.p., under a head of 250 feet, and in the other, four units, each of 11,500 h.p., under a head of 165 feet.

The same firm are further supplying the water wheels and pipe lines for a high pressure plant in the Pyrenees, built by a concern controlled by the Barcelona Traction Co. There are five turbines of 7,000 h.p. capacity each under a head of 2,800 feet.

Bulletin A. 4134 has been issued by the Canadian General Electric Co., Toronto, and deals with apparatus for drying and filtering transformed oil and for drying transformers. The principle of operation and detailed description of the apparatus is given together with illustrations of the various types and tables of capacities, etc. A high potential oil testing outfit and aluminum lighting arresters are also dealt with in the bulletin.

POWER PLANT DEVELOPMENTS

A record of current municipal, manufacturing and general industrial projects, involving steam, gas, oil, electricity, air and water power equipment requirements.

Electrical

Burford, Ont.—An effort will be made to get Hydro-Electric power here.

St. Catharines, Ont.—The ratepayers have voted in favor of Hydro-Electric power.

Lacombe, Alta. — The municipality will instal a twenty-five light electric system.

Quebec, Que.—The Dorchester Electric Co. will improve the lighting in Limoilou.

Grantham, Ont.—The Ratepayers of this township are asking for Hydro-Electric rates.

Brockville, Ont.—The town will spend $69,000 to extend the light and power systems.

Fonthill, Ont.—Arrangements are being made to have the village lighted by electricity.

Woodville, Ont.—The sum of $4,000 will be expended on an electric distributing plant.

South Bolton, Que.—A steam power plant will be installed by Mr. Houldsworth in his mill.

Weston, Ont.—The Water, Power and Light Commission will instal high voltage tanks in the streets.

Fergus, Ont.—The village will borrow $10,000 to establish a local distributing plant to utilize hydro power.

St. Mary's Ont.—$5,870.30 has been passed for extension and improvement in water and electric light works.

Fredericton, N.B.—Tenders will be called for an electric lighting and power system for the city opera house.

Elmira, Ont.—Hydro-Electric power was formally installed in Elmira on October 29. The village will take 250 h.p.

Yorkton, Sask.—The town is building a power house at a cost of $36,000. Ritchie & Walters, general contractors.

Westmount, P.Q.—The Corporation of Westmount have appropriated $25,000 for street lighting for the coming year.

Bury, Que.—The Westbury Electric Light and Power Co. intend installing electric light in Bury in the near future.

Thorold, Ont.—A Hydro-Electric engineer has been appointed to estimate the cost of the system for Thorold township.

Moose Jaw, Sask.—The Kasow Electric Co., and the A1 Electric Co., both of Moose Jaw, have assigned in favor of creditors.

Strathroy, Ont.—The Hydro-Electric Commission will supply Strathroy with 200 h.p. at $44 per h.p. for a 24-hour service.

London, Ont. The London Street Railway Co. will take power from the city, a satisfactory price having been agreed upon.

Winnipeg, Man.—The city will ask the ratepayers for $1,000,000 to be spent on a power plant, and $85,000 for an incinerator.

Smithers, B.C.—J. L. Hamilton and J. Fraser have selected a site on which they will erect an electric light plant and waterworks.

Winnipeg, Man.—The Provincial Government will erect a power house to cost $158,000. General contractors, National Construction Co.

Welland, Ont.—The Canada Forge Co. have begun work on a new transformer house, which will double the capacity of their present one.

Toronto, Ont.—The City Hydro-Electric Commission will issue from $1,000,000 to $2,000,000 additional bonds to extend the system.

Grantham, Ont.—The township has been offered electric power by the Hydro-Electric Commission at very low rates. $38,000 will be spent on construction.

Regina, Sask.—The Estevan Transit and Power Co., Ltd., will apply for incorporation in Saskatchewan as a power and railway company.

Fergus, Ont.—This village will spend $16,000 on Hydro-Electric power, and the village of Elora, Ont., will take 200 h.p. and spend $10,000.

Port Arthur, Ont.—The C. N. R. are installing an electric plant at Atikokan, the chief divisional point between Port Arthur and Fort Frances.

Hamilton, Ont.—Engineer Webb of the Ontario Hydro-Electric, is preparing plans for providing the township of Barton with hydro power.

Edmonton, Alta.—Plans and specifications will be prepared for an extension to the civic power plant, and tenders called for at an early date.

Montreal, Que.—A winding-up order has been granted against the Universal Electric Economy Co., Ltd., on the application of Walter Rawlings.

Vancouver, B.C.—The city is seeking additional water power. Ald. Black, chairman of the civic water committee, has been to Victoria about it.

Outlook, Man.—The town has passed the following:—$10,000, municipal rink; $10,500 for electric light extension; and $3,500 for waterworks extension.

Victoria, B.C.—The city council has authorized improvements to the city's electric light plant, which will provide workshop facilities for the employees.

Strathroy, Ont.—The ratepayers must either take Hydro power or spend a large sum on the municipal plant. The wiring is bad, and a new boiler is required.

Medicine Hat, Alta.—Plans are being prepared for an addition to the municipal power plant and the installation of machinery, estimated to cost $250,000.

New Glasgow, N.S. — The Pictou County Electric Co. have purchased new equipment, consisting of boilers, engines, generators, etc., for their power plant at Stellarton, N.S.

Edmonton, Alta.—It is estimated by the Hon. Mr. Sifton, premier of Alberta, that there will be a surplus of $100,000 on the Government telephone operation for this year.

Smith's Falls, Ont.—The council have decided to ask the Hydro-Electric Commission to develop power from Long Rapids on the Madawaska River, and transmit it to Smith's Falls.

Brantford, Ont.—Engineer J. J. Jeffery of the Ontario Hydro Commission has been inspecting Parkdale, Grandview, Echo Place and Paris Hill in response to the petitions from these places for electric energy.

Grand Falls, N.B.—The town has just completed the installation of an electric lighting system. Power is supplied by the Maine & New Brunswick Electrical Power Co., whose power house is at Aroostook Falls, N.B.

Swift Current, Sask.— The Gillstrom Contracting Co. have been awarded a contract by the city to build a power house. Geo. D. Mackie, engineer.

Kingston, Ont. — The Corporation have decided to construct a system of underground conduits upon four of the principal streets, abolishing the unsightly poles.

Cornwall, Ont. — The St. Lawrence Power Co., of Massena, has been granted permission to dredge the Grasse River. from the power house to its mouth, a distance of nine miles.

Owen Sound, Ont.—The Council has authorized the Mayor to sign a contract with the Hydro-Electric Commission for twelve to fifteen hundred horse-power from Eugenia Falls.

Brantford, Ont.—A plan to develop 2,500 horse-power at Mohawk Lake to take care of its peak load in Brantford is under consideration by the Dominion Power & Transmission Co.

Windsor, Ont.—The city council has taken up the question of buying the street railway to ensure the success of the Hydro-Electric plant from the start, by stopping competition.

St. Hyacinthe, Que.—The town council have granted the electric lighting and power privilege to Clarence McCuaig & Co., of Montreal. This is a thirty-year franchise.

Hamilton Hydro Report.—The financial statement of the Hamilton Hydro-Electric Department shows a gross profit of $26,000, and a net profit of $6,000 for the past eight months. Engineer Sifton says $335,264 is needed to complete the system.

Montreal, Que.—The Laurentide Pulp and Paper Co. will drive all their machinery by electricity when the new power house supplying 100,000 h.p. is completed.

Windsor, Ont.—J. M. Goodall, who is in charge of construction work on the transmission line from St. Thomas to Windsor, says power should be turned on by next winter.

Winnipeg, Man.—A by-law has been passed by the city council for a vote of the ratepayers on the expenditure of $1,000,000 for extension to the hydro-electric system.

Brockville, Ont.—A by-law has been passed by the Council of Brockville for raising the sum of $69,000 for the improvement and extension of the present light and water systems.

Gananoque, Ont.—John M. Campbell is building a dam at Kingston Mills to increase the fall from 10 to 40 feet. He will instal turbines, and generate electricity for local farms.

Owen Sound, Ont.—The Hydro-Electric plans for a plant at Eugenia Falls have been approved by the Electric Light and Power Committee of the town council, and a by-law will be drafted.

North Battleford, Sask.—The city will investigate the possibilities of developing power three miles west of the city on the North Saskatchewan river. It is believed 40,000 h.p. can be generated.

Edmonton, Alta.—Plans have been prepared and a tender obtained for a steam engine for the street railway power department. The price is $11,460. A surface condensing plant is also required.

Morrisburg, Ont.—The Hydro-Electric Power Commission is generating power from a power house owned by the municipality. Prescott, Morrisburg, Winchester and Chesterville will be supplied.

Weston, Ont.—Weston Electric Light Commission have decided to sell electric supplies to the residents of the municipality. Dr. E. F. Irwin and Secretary A. Pearson have been appointed to make the purchases.

Prince Albert, Sask.—The city will ask the Legislature to allow it to borrow $2,500,000 for construction work on the Lacolle Falls power plant, and to extend the time for completion for a period of three years.

Davidson, Sask.—The Canada Gas Producer Co., of Barrie, Ont., propose to instal an 80 h.p. gas engine and electric generator, together with a gas producer and other necessary equipment, for $8,500, in the town's power house.

Toronto, Ont.—It is definitely settled that the Provincial Hydro-Electric Commission will issue an order for the installation of street lights and house services in Swansea and Runnymede within the next month or two.

Winnipeg, Man.—The Winnipeg Electrical Railway has secured the Great Falls Power Co. waterfall on the Winnipeg River, situated midway between Lac Du Bonnett, the Electric Railway Co.'s present site, and mouth of river.

Galt, Ont.—Three more transformers have been placed in the Dickson Street hydro sub-station, making six there, and, with three in the Getty & Scott sub-station, Galt has now a transformer capacity of 1,800 horsepower.

London, Ont.—The London Street Railway has signed a contract with the City of London and the Hydro-Electric Commission of Ontario for from 1,000 to 3,000 h.p. to operate its lines. The company will use direct current.

Orillia, Ont.—The Water, Light and Power Commission, represented by J. B. Tudhope and C. H. Hale, has asked the council to consider a by-law to raise $80,000 for new machinery and equipment in the new power house to be built at Swift's Rapids.

Nelson, B.C.—Construction work on the new units for the West Kootenay Power and Light Co., at Bonnington Falls, to supply power to operate the Rossland-Castlegar division of the C. P. R. will commence on January 1. The machinery has been ordered.

Ottawa, Ont.—Plans and description of the site of proposed water power development at High Falls, on the Madawaska River, in the County of Renfrew, have been filed at Ottawa. This is probably for the Ontario Hydro-Electric Commission.

Mirror Lake, B.C.—The Mirror Lake Electric Light Co., Ltd., have installed a light and power plant here. The equipment purchased consisted of an Edison 35 k.w. 110-volt generator and attachments. The wiring and other work were done by W. R. Godfrey of the McKenzie Electric Co., Lethbridge.

Toronto, Ont. — The contract to sell the T. Eaton Co. 2,500 horse-power per annum represents one of the biggest individual contracts yet signed by the Toronto Hydro-electric Commission. The cost to the company will be in the neighborhood of $30,000 per annum, and the Commission states that it will have to increase its supply from the Ontario Power Commission in order to cope with the increased demand.

Port Arthur, Ont.—The city solicitor has been authorized to prepare by-laws for the following: $8,000 for street lighting; $35,000 for street railway extensions; $35,000 for a telephone system; $50,000 for a high tension power line.

Sherbrooke, Que. — The Sherbrooke Railway & Power Co. have purchased from C. E. Kennedy, of Coaticook, the electric lighting franchise of Ayer's Cliff, Que. This includes light and power and the franchises for street lighting for a term of years.

Chatham, Ont.—The Hydro Commission will be asked to assist the city council in valuing the electric department of the Chatham Gas Company, with a view to the city purchasing it for use in distributing power to Chatham consumers.

Souris, Man. — The town has just closed a contract for a large $4,000 electric light plant. The contract has been awarded to the Accumulator Lighting Co., Winnipeg, who will instal one of its storage battery systems. The town will be lighted with ornamental five light clusters.

London, Ont.— The ratepayers have voted in favor of electrifying the London and Port Stanley Ry., a municipally owned line, at a cost of $700,000. A commission of five will be named to manage the work, and the following will probably be appointed: Mayor Graham, Hon. Adam Beck, Philip Pocock, Lt.-Col. W. M. Gartshore, and M. O. Fraser, K.C.

Hamilton, Ont.—The Dominion Power and Transmission Co. have completed plans for an auxiliary steam power plant at the foot of James street, to develop 27,000 h.p., costing $1,250,000. W. C. Hawkins, managing director, is authority for this statement. Provision will be made for the addition of units reaching a maximum of 90,000 horsepower in later years, which will entail an outlay of $3,500,000.

Water Works

Sydney, N.S.—The city is building an addition to its pumping station.

Sudbury, Ont.—The town will spend $5,000 on extension to water mains.

Chapleau, Ont.—The township will spend $5,000 for an extension to the water mains.

Toronto, Ont.—Works Commissioner Harris, is preparing plans for a great sewer system for North Toronto, and districts East and West, to cost approximately $6,000,000.

Toronto, Ont.—The city will erect a large sewage disposal works on the Don banks, costing about $2,000,000.

Tilbury, Ont.—The Michigan Central Railroad will build a large pumping station to supply the town with water.

Melfort, Sask.—The town has been authorized to spend $34,000 on waterworks and $16,000 for sewerage system.

Regina, Sask.—The addition of another filter bed to the sewage disposal works is contemplated by the city council. F. McArthur, city engineer.

Winnipeg, Man.—The Empire Waterworks Supply Co. of Canada, Ltd., have been incorporated at Winnipeg, and will manufacture waterworks supplies of various kinds, including piping, etc. The company is capitalized at $100,000.

Contracts Awarded

Westboro, Ont.—The ratepayers have awarded a 10-year contract for lighting the streets to the Ottawa Electric Co.

Winnipeg, Man.— The John Dolman Co., Winnipeg, has been awarded a contract for installing boilers in the new civic power plant at $5,700.

Prince Albert, Sask.—Contracts have have let to Kilmer, Pullen & Burnham, agents, the Swedish General Electric Co., Toronto, for the supply of generators for La Colle Falls water power development.

Montreal, Que.—A contract for a 450 h.p., 250 r.p.m., 550 volt, 25 cycle, slip ring type induction motor, together with a Siemens type liquid starter, has been placed with the Siemens Company of Canada, Ltd., by the Dome Mines Co. of South Porcupine. The motor is to be used to drive a compressor made by Belliss and Morcom.

Ottawa, Ont.—The contract has been let for the construction of a government experimental cold-storage plant at Grimsby, Ont. The plant will cost $25,000, and will have a capacity of 50,000 cubic feet. It will be ready for operation by next fruit season. J. A. Ruddick, chief dairy and cold-storage commissioner, Ottawa.

Vancouver, B.C.—The York Manufacturing Co., makers of ice-making and refrigerating machinery, York, Pa., have made an installation for the Mainland Ice & Cold Storage Co., Ltd., Vancouver, B.C., consisting of one 90-ton vertical single-acting chain-driven refrigerating machine with high pressure side complete, using flooded ammonia condensers; also one 50-ton flooded freezing system complete.

Thor Iron Works, Ltd., of Toronto, have been awarded the contract for the standpipe at Timmins, Ont., by the Canadian Mining and Finance Co. The standpipe will be 20 feet in diameter and 95 feet high, with a total capacity of 225,000 gallons. Of this capacity, 50,000 gallons will be held as a reserve for fire protection purposes. The standpipe will be erected before the severe weather begins.

Toronto, Ont.—The Linde-Canadian awarded the contract for refrigerating machinery for the new civic abattoir by the architects, Wm. R. Perrin & Co., Chicago. This consists of a 90-ton double acting ammonia compressor driven by a 140 h.p. motor, a liquid ammonia receiver, and a Linde double pipe ammonia condenser, expansion pipe for various rooms, etc.

Saskatoon, Sask.—The city has awarded a contract to the Canadian Westinghouse Co. for two electrically driven pumps. The pumps will be supplied by the Turbine Equipment Co., Peterkin Bldg., Toronto, who are agents for De Laval pumps and steam turbines. One is a 6,000,000 and the other a 4,000,000 gallon pump, and both will be used for the filtration plant. The Canadian Westinghouse Co. supply the induction motors to run these.

Kilmer, Pullen & Burnham, Toronto, have been awarded a contract by the city of Prince Albert, Sask., for two vertical type generators, 1875 K.V.A. each, 2,200 volts, 3-phase, 60 cycles, 138 r.p.m., and two vertical type exciters, 150 k.w. each, at 300 r.p.m., all made by the Swedish General Electric Co. These are to be used in the power house at LaColle Falls, the development of which has been held up for financial reasons.

Canadian General Electric Contracts.—The new G. T. P. floating dry dock at Prince Rupert, B.C., will be one of the largest and best supplied in the world, and will be electrically operated throughout. The contract for the electrical equipment, which has been awarded by the G. T. P. to the Canadian General Electric Co., Ltd., includes two 200 h.p. and four 100 h.p. variable speed induction motors, with full automatic control, for operating the pumps on the dock. The power will be produced by two 1,250 K.V.A. Curtis steam turbines, with complete condensing apparatus. The exciters for the main turbine-generators will consist of three 35 K.W. turbine driven generators and one motor generator set. The foundry, machine shops, and shipyards will be equipped with motor driven tools, requiring motors ranging from 60 to 10 h.p. The contract for electrical equipment also

includes all necessary power and light transformers.

The Garlock Packing Co., Hamilton, Ont., have opened a branch at Calgary, Alta., where a stock of packings will be carried. This branch is under the managership of J. T. Dohm, who is well known in British Columbia and Alberta. L. G. Hargreaves, of the Garlock Western staff, has been appointed Winnipeg branch manager, and W. B. Powell will represent the company in Manitoba and Saskatchewan. The Garlock Co. now have branches in Montreal, Toronto, Winnipeg, and Calgary.

Canadian General Electric Contract.—The town of Aurora, Ont., has decided to instal an equipment of motor driven turbine pumps for protection against fire. It will include two four-stage high lift turbine pumps of Mather & Platt design, built by Canadian Allis-Chalmers, Ltd. Each of these fire pumps will be capable of delivering 400 Imperial gallons per minute, against a total head of 325 feet, when operating at 1,460 r.p.m. They will be direct connected at one end to an alternating current motor, and at the other end to a direct current motor in order to conform with the underwriters' requirements that there must be two distinct sources of power for this purpose. The electrical apparatus, including a four panel switchboard, will be built by the Canadian General Electric Co., Ltd.

New Incorporations

Heinze Electric Co. Ltd., incorporated at Toronto, capital $50,000, to manufacture and deal in electrical apparatus and supplies, at Walkerville, Ont. Incorporators: Paul Butler, Butler Ames, etc. Lowell, Mass.

Gray Pneumatic System, Ltd., incorporated at Ottawa, capital $500,000, to acquire and work inventions and patents for pneumatic systems of starting internal combustion engines, etc., at Toronto. Incorporators: John M . Duff, Frank Regan, etc. Toronto.

The Pierson Gas Producer Plant Co. Ltd., incorporated at Ottawa, capital $100,000, to import, manufacture and fit up the Pierson gasogenes, with motor and all necessary machinery, at Montreal. Incorporators: Pierre V. Rougier, Arthur Decay, etc., Montreal.

The Valleyfield Water Power Co., Ltd., incorporated at Ottawa, capital $1,000,000, to carry on the business of an Electric Light, Heat & Power Company in all its branches, at Salaberry de Valleyfield, Que. Incorporators: Noel A. Ostiguy, John Lowe, etc., Salaberry de Valleyfield.

Municipal

Fort Francis, Ont.—$12,000 for telephone purposes was finally passed by the council.

Todmorden, Ont.—Ratepayers are urging fire protection and a better water system.

Salmon Arm, B.C.—The council hope to secure $12,000 to complete the waterworks system.

Edmonton, Alta.—The city is building an asphalt plant to cost $5,000, two storeys, 27x53.

West Vancouver, B.C.—The ratepayers have voted $40,000 for a wharf at Dundarave.

Oak Bay, B.C.—The municipal council will purchase water mains for a waterworks system.

Sudbury, Ont.—The council will extend its water mains at a cost of $5,000. Clerk, George Elliott.

Kamloops, B.C.—The city is contemplating the erection of a gas plant at a cost of $75,000.

Delhi, Ont. — The town council will spend $32,000 on a waterworks system. Roger Crysler, clerk.

Peachland, B.C. — The Corporation will spend $1,000 on additions to the electric lighting system.

Verdun, Que.—The city council have raised $200,000, which will be spent on sewer extensions and paving.

Hamilton, Ont.—The ratepayers will vote on a scheme to raise $200,000 for a new hospital, in January.

Toronto, Ont.—Works Commissioner Harris will again recommend the purchase of a stone quarry by the city.

Welland, Ont.—The council is considering the supply of water to Crowland. The cost of the extension would be $1,500.

Dundas, Ont.—The Mayor has been empowered to sign a contract for from 275 to 300 street lights of 100 watts, at $9.00 each.

Hull, Que.—The Hull City Council will begin at once the construction of the macadamized road between Hull and Gatineau Point.

London, Ont. — Two boilers costing about $7,000 are needed to heat Victoria Hospital. Mayor C. M. R. Graham, Engineer, H. P. Elliott.

Winnipeg, Man.—The council of Kildonan, a suburb of Winnipeg, is considering the question of installing waterworks and sewerage system.

Ingersoll, Ont.—Engineer F. W. Thorold, of Toronto, has submitted to the council plans of a sewage system, the estimated cost of which is $59,000.

Dundas, Ont.—The town council will build a sewage disposal works, and try to obtain a water supply from Lake Ontario in conjunction with Hamilton.

Sarnia, Ont.—The assessment of the Perfection Stove Co. has been fixed at $25,000. A by-law to extend water mains and sewers has been carried.

Kingston, Ont.—On Nov. 3 the ratepayers will vote on a scheme to grant aid by bonus of $10,000 to Frank Vandersept Samwell, tube manufacturer.

St. Marys, Ont.—The by-law providing for a loan to the St. Marys Milling Co. for an addition to their plant, which was defeated, will be submitted again.

Lennoxville, Que.—The Lennoxville Waterworks Co., through its superintendent, N. H. Greene, has offered to sell the waterworks to the town for $34,000.

Welland, Ont.—The old waterworks plant is being repaired at a cost of $500, and will be used as an auxiliary in the event of a breakdown at the new plant.

Ottawa, Ont.—The Waterworks Committee will purchase 180 fire hydrants next year, costing $20,000. City Engineer Currie will spend $5,000 now on hydrants.

Winnipeg, Man.—The Bank of Montreal is prepared to finance the entire $13,500.000 loan that will be required for the carrying out of the Shoal Lake water project.

London, Ont.—Willis Chipman, of Toronto, and city engineer W. N. Ashplant, last week outlined before the council a program for carrying the $400,000 storm sewer project through.

Weston, Ont.—The Weston Water, Power and Light Commission have decided to lay a 4-inch water main on the north side of St. John's Road, at the request of the York Colonization Co.

Medicine Hat, Alta.—The city will submit by-laws authorizing the expenditure of the following sums: $175,000 on a waterworks system; $60,000 on storm sewers; $12,000 on additional fire apparatus; $50,000 for repairs to roads and purchase of road construction plant and machinery; $150,000 for increasing and extending electric light; and $50,000 for drilling gas wells.

Medicine Hat, Alta.—The city council will submit to the vote of ratepayers upon November 21st, a by-law for the appropriation of $50,000 to be used in grading and gravelling streets, and for the purchase of the plant and machinery.

Guelph, Ont.—The Light and Heat Commission will purchase a complete gas heating outfit, and try it out in the gas and electric light building. If satisfactory they will be sold for use in private houses.

London, Ont.—The Ontario Railway and Municipal Board has dismissed the application of Swift-Greene, Limited, of London, to lay steam pipes across Carling Street for the purpose of supplying buildings with heat.

Bow Island, Alta.—The municipal gas well at Bow Island, with a capacity of 10,000,000 cubic feet per day, has been completed. The money has been raised by local subscription, and free gas is being offered for new industries which wish to locate there.

Maisonneuve, Que.—The city has applied to the Legislature for permission to build a police and fire station, and to equip with necessary fire apparatus. Agreements will be made with the interested companies for the burying of wires in certain streets.

Medicine Hat, Alta.—The ratepayers will shortly vote on the following by-laws: $50,000 for grading and graveling the streets; $12,000 for apparatus for fire department; $60,000 for building storm sewers, and $150,000 for extensions to light and power plant.

The Smart-Turner Machine Co., Ltd., Hamilton, Ont., have recently secured the following orders: The Canada Ice Machine Co., Fort Qu'Appelle, Sask., one Duplex Power Pump; Geo. Gordon & Co., Cache Bay, Ont., Duplex Pump; The Institute for the Blind, Brantford, Ont., one Vacuum Pump; The Otis-Fensom Elevator Co., Toronto, one Underwriter Fire Pump; Mr. F. L. Snively, Dunnville, Ont., one Duplex Pump; The Harbor Commissioners of Montreal, Que., one Simplex Power Pump; The Dominion Canners, Ltd., Burlington, Ont., one Duplex Pump; The London Cold Storage & Warehouse Co., London, Ont., one Duplex Power Pump.

Tenders

Winnipeg, Man.—Tenders addressed to the chairman, Board of Control, will be received up to Saturday, November 15th, for the supply and installation of five complete pumping units, together with step down transformers, switch board and accessories.

Toronto, Ont.—Tenders will be received up to November 18, for the supplying and laying of an 84-inch steel conduit from the Pure Water Reservoir on Toronto Island to the South Tunnel Shaft.

Toronto, Ont.—Tenders will be received by the chairman of the Board of Control, Toronto, up to November 18th, for:—Brass and bronze castings, brass work for house services, cast iron pipes, hydrants, iron valve and stop cock boxes, lead pipe, special castings, stop valves.

Specifications and tender form for any of the foregoing may be obtained upon application at the head office of the Department of Works, City Hall, Toronto. H. C. Hocken (Mayor), chairman Board of Control.

Refrigeration

Brantford, Ont.—The Brantford Ice Co. have decided to erect an ice manufacturing plant at a cost of about $45,000.

Westmount, Que.—The Centerfreeze Sanitary Ice Co., Merchants Bank Building, Montreal, is contemplating the erection of an artificial ice plant here.

Winnipeg, Man.—Premier Roblin, of Manitoba, says the Government will erect a public abattoir at the new Union Stock Yards here, to encourage live stock industries.

Quebec, Que.—The Quebec Abattoir Co. have been granted tax exemption of ten years by the city. They will go ahead and build now. Hon. J. E. Roberge, president.

Belleville, Ont.—The Belleville Cheese Board has decided to request the Government to assist the Steamship Companies in equipping terminals and steamers with cold storage plants.

Trade Gossip

Transcona, Man.—The city council is objecting to a 13,000 volt. transmission line for the N.T.R. shops being strung through the streets on the ground that it is dangerous.

W. H. Bytham has resigned his position as manager of the Montreal branch of the Canadian Union Electric Co. to take up a directorship in the Electrical Repair & Contracting Co. in Montreal.

The International Engineering Works, Ltd., of Amherst, N.S., have recently opened three new offices in addition to their regular offices at Montreal, Toronto, etc. These and the representatives are: George M. Taylor, 816 Burrards St., Vancouver, B.C.; J. F. Tracey, 321 Edmonton St., Winnipeg, Man.; and Grodwards Co., Cobalt., Ont.

The Electric Mfg. Co., of Canada, Ltd., incorporated at Ottawa; capital $2,000,000, to carry on the business of electrical and mechanical engineers, at Montreal. Incorporators: Howard S. Ross, Eugene R. Angers, etc., Montreal.

The Turbine Equipment Co., Peterkin Bldg., Toronto, have been awarded contracts by the Ontario Government for De Laval centrifugal pumps, one with a capacity of 200 Imperial gallons a minute against 230 ft. head for the Hospital for the Insane, Penetang, and another of same capacity against 140 ft. head for the Hospital for the Insane, Orillia.

Brass Flange Standard.— An American standard for dimensions for brass flanges was adopted on September 17 by the Committee of Manufacturers on Standardization of Fittings and Valves, effective January 1, 1914, and a copy of the pamphlet giving the tables of the dimensions can be obtained by addressing W. H. Douglas, secretary of the committee, 30 Church street, New York City.

The British Manufacturers' Association, Ltd., whose head offices are in London, England, have established a Canadian branch at 803 McGill Building, Montreal. This office is in charge of Mr. R. J. McLean. The firm have branches in the Argentine, Brazil, Egypt, Sweden and elsewhere. They act as manufacturers' agents for a number of well-known British firms, and handle steam engines, steam and water turbines, machine tools, and also all classes of high grade steel, including forgings and tool steels.

Personal

W. S. Harvey has been appointed city engineer of Lethbridge, Alta.

G. Janin, chief engineer of Montreal, has just returned from a visit to Europe.

J. L. Lang, B.A.Sc., has accepted a position in Galt as assistant to the city engineer.

Geo. Caverhill, of Caverhill, Learmont & Co., Montreal, celebrated his fifty-fifth birthday recently.

Dr. Imhoff, inventor of the Imhoff tonk system of sewage disposal, is visiting in Canada.

J. K. L. Ross has been elected a director of the Canadian General Electric Co. to fill the vacancy created by the death of his father, the late James Ross.

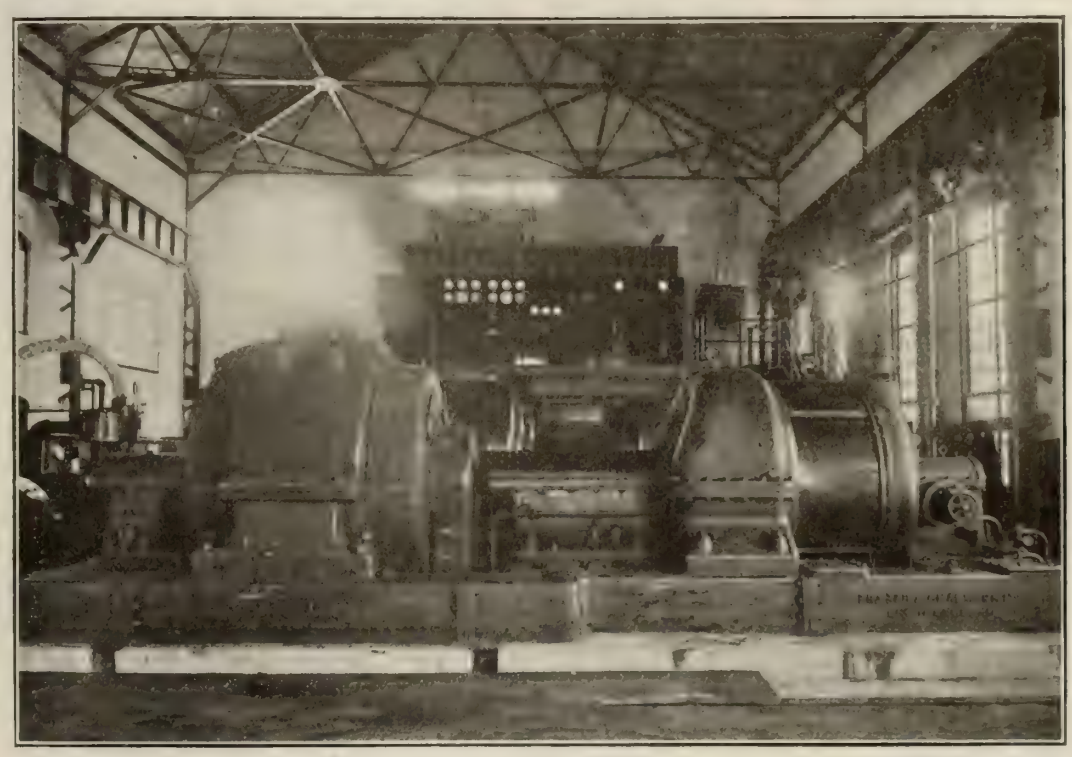
10 h.
equipm

SIEMENS BROS. DYNAMO WORKS | SIEMENS BROS. & CO.

SIEMENS

SIEMENS - SCHUCKERTWERKE | SIEMENS & HALSKE

SIEMENS



Siemens 2500 K.W., 25 Cycle, 6600 Volt Turbo Generator with Switchboard, supplied to the Dominion Coal Company, Nova Scotia.

The following Siemens Turbo Generators have been supplied or on order for Canada:

1—4,000 K.W. Edmonton.
1—2,500 K.W. Dominion Coal Company.
3—2,000 K.W. Dawson City.
1—2,000 K.W. Edmonton.
2—1,500 K.W. Regina.
1—1,500 K.W. Lethbridge.
1—1,500 K.W. Moose Jaw.
1— 750 K.W. Nova Scotia Steel and Coal Co.
2— 750 K.W. Medicine Hat.
2— 500 K.W. Nova Scotia Steel and Coal Co.
1— 500 K.W. Wayagamack Pulp and Paper Co.

The Siemens Companies have supplied more than 100 Turbo Generators of 4,000 K.W. or over.

Siemens Company of Canada, Limited

HEAD OFFICE:

Transportation Building - MONTREAL

BRANCH OFFICES:

STANDARD BANK BUILDING
TORONTO

McARTHUR BUILDING
WINNIPEG

The advertiser would like to know where you saw his advertisement—tell him.

Charles R. Hosmer has been elected president of the West Kootenay Power & Light Co., succeeding the late W. M. Doull, who died two weeks ago.

Thomas C. Keefer, C.M.G., of Ottawa, has been elected an honorary life member of the American Society of Civil Engineers.

O. M. Perry, Belleville, has been appointed superintendent of hydro work in Windsor, Ont., at a salary of $150 a month.

Robert L. Clarke, electrician employed at the power house, Bobcaygeon, Ont., was the victim of a shooting accident on Tuesday last, while out hunting.

N. B. Wilkes, who has been at the head of the Watrous (Sask.) Electric Light, Power and Traction Co. since the time of its installation, has resigned.

Leonard Miller, B.A.Sc., son of C. J. Miller, of Orillia, has been appointed manager of the electric plant at Watrous, Sask.

T. C. Irving, jun., has been re-elected vice-president of Robert W. Hunt & Co., Ltd., inspecting engineers, and will remain in charge of the Toronto office.

Charles Margerison has been put in charge of the City of Toronto marine plant. He will start with the building of a $15,000 scow. He was a diver for the city prior to this promotion.

W. G. Chace, B.A., Sc., of the firm of Kerry & Chace, Ltd., Toronto, has been appointed chief engineer for construction of the Greater Winnipeg Waterworks at a salary of $8,000 for the first year and $9,000 for the second.

A. Leo Mieville, until recently the Canadian representative of W. H. Allen, Son & Co., Ltd., Bedford, Eng., has joined the staff of Kerry and Chace, Ltd., consulting engineers, Toronto, and has gone west on business.

Sir Alexander Binnie has been elected engineer-in-chief of the Ottawa Gatineau Lakes water scheme, the employment fee being $400,000, out of which Sir Alexander is to pay his small army of subordinate engineers and inspectors.

Alexander Jeffrey, a well known Montreal contractor and millwright, died suddenly in that city on October 30 at the age of 78. Mr. Jeffrey was born on the Island of Montreal, near St. Michel, in 1835, and had been in business in the city for the past fifty years as a millwright and contractor, and in that capacity had undertaken many of the best known engineering works in Montreal. He executed many Government contracts along the Lachine Canal and constructed the forebays and tailraces for several of the factories located there. Some years ago Mr. Jeffrey built the Lachine Hydraulic Works, now part of the Montreal Light, Heat and Power system. The work by which he is best known, however, and will long be remembered in Montreal was the construction of the Mountain Incline Railway, which was undertaken some fifteen years ago.

L. C. Randolph is resigning his position as advertising manager with the Canadian Fairbanks-Morse Co. in order to represent the Industrial and Educational Press, Ltd., Montreal, in the United States. Mr. Randolph will be their sole representative in the U.S.A., and will have his headquarters in New York city.

Book Reviews

The Bureau of Mines Branch of the Department of the Interior of the United States Government, Washington, D.C., have recently issued bulletin No. 22, entitled "Analyses of Coals." The bulletin is published in two parts, part 1 being devoted to analyses, and part 2 to descriptions of samples. A great deal of valuable information is given relative to coal and coal mining in the United States.

The Commission of Conservation appointed by the Dominion Government have published their report on the Long Sault Rapids, St. Lawrence River. Some time ago an enquiry was instituted in connection with a power scheme which the Long Sault Development Co. proposed to launch. This report is the result of this enquiry, and contains all the expert evidence taken both in Canada and the United States relative to the advisability of granting a charter to the company. The report is exhaustive, much of the evidence being of a legal or technical nature. The part referring to ice conditions on the St. Lawrence River is both instructive and interesting. The report contains a number of excellent illustrations and three maps.

Catalogues

The Mesta Machine Co., Pittsburgh, Pa., have issued a bulletin dealing with the Mesta gas engines. The principal features of the "Mesta" engine are explained in detail and the advantages set forth. The bulletin contains views of some large installations. Copies may be had by writing.

The Canadian Westinghouse, Ltd., Hamilton, Ont., have issued circular No. 1205, which deals with carbon circuit-breakers. The various types which they make are fully described and illustrated, their chief features being carefully explained. Copies of this circular will be mailed on request.

The "Losles" Automatic Electric Water Heater is the subject of a pamphlet which we have received. The claims for its consideration are clearly set forth and comparison made with similar apparatus using gas for heating. Copies of this pamphlet may be obtained from Geo. Wilkinson, Harrogate, Eng.

The Elliott Company, Pittsburgh, Pa., have published bulletin E, descriptive of the steam and oil separators made by them. Each type is clearly illustrated, showing the general construction, together with a comprehensive description of the method of working. Tables of dimensions are given for each type and size. Copies may be had by writing.

The Triumph Ice Machinery Co., Cincinnati, Ohio, have sent us a copy of catalogue E, which deals with the "Triumph" ammonia fittings, and covers the full line manufactured by them. Each style of fitting is illustrated, and tables giving the principal dimensions for each size and code words are also included. The catalogue is well got up, the tables and illustrations being neatly arranged.

Feed Water Heaters made by the Elliott Company, Pittsburgh, Pa., are fully described in bulletin O which we have received. The various types made by this company are carefully explained and the illustrations show clearly the general design. The principal features embodied in the design are dealt with and illustrated. This is an attractive catalog and copies may be had on request.

Corrugated Copper Expansion Joints.—In the catalogue describing corrugated copper expansion joints, just issued by E. B. Badger & Sons Co., Boston, Mass., we find two tables which contain data of value to every consulting and designing engineer, and to operating engineers who may have occasion to make changes in their steam lines. These tables give the lengths of pipe cared for by Badger expansion joints. The above Company will be glad to send a copy of the catalogue to anyone asking for it.

Thermofeed is the title of a new catalog published by Ronald Trist & Co., Ltd., London, Eng., and describing the "Thermofeed" system of boiler feed regulation. A description is given of the "Thermofeed" regulator with instructions for installing. This is an attractive catalog, the illustrations being clear and in some cases colored, which heightens the effect. This is very noticeable in the colored sectional views which are very distinct. Copies may be had by writing.

Why Is the Liberty Cleaner the Best?

Cyclone for Air or Steam with "Norivet" head.

Because the freely swinging arm has a hammering as well as cutting effect, and reaches clear to the iron. No other cutting head has this special feature.

Because, the motor driving the cutters has the power to do the work quickly.

Because, the work can be done at a low cost for repairs.

Because, on account of their construction they will operate successfully under less pressure than any other type of air, steam or water cleaner.

Because, most of the large power plants have found it the best and most economical, and have adopted it as standard, and finally,

Because, it has proven its superiority over other types of cleaners in hundreds of hard competitive trials. If you have tried out any other cleaner and failed, let us send you a Liberty to show you what a real Cleaner will do.

Liberty Manufacturing Company

6904 Susquehanna Street PITTSBURGH, PA.

Canadian Representatives:
Williams & Wilson, Ltd., Montreal. A. R. Williams Machinery Co., Toronto and Winnipeg.

"TWINS" EXCITE ADMIRATION

Because They Earn It

Think of a TWIN when you hear the word STRAINER

The installation of a Twin Strainer on your water supply line eliminates troubles, worry, waste of time and expense—because

It has two straining baskets—that may be cleaned alternately, thus permitting continuous operation.

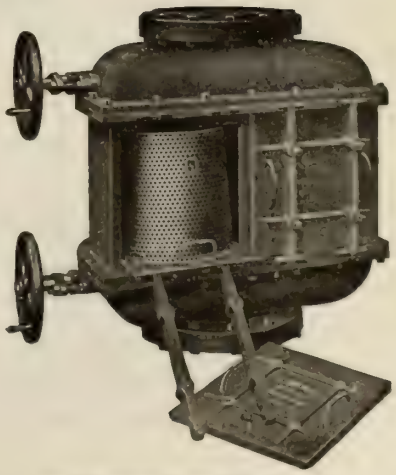
It has but two valves—they are of the gate type and are always tight.

It gives a direct flow with minimum friction loss, insuring easy operation with no waste of energy.

In fact, a Twin Strainer is an insurance policy in active service.

Designed to protect and built to last.

Write for our bulletin.



THE TWIN STRAINER.

ELLIOTT COMPANY

6902 Susquehanna Street, PITTSBURGH, PA.

Manufacturers of Filters and Grease Extractors, Separators, Blow-off Valves, Feed Water Heaters and General Power Accessories.

CANADIAN REPRESENTATIVES:
Willams & Wilson, Ltd., Montreal. A. R. Williams Machinery Co., Ltd., Toronto and Winipeg.

The advertiser would like to know where you saw his advertisement—tell him.

Save Your Time ! !

Time is the business man's most important asset, and to get the most out of a given amount of time his problem.

The many demands made upon his time makes it difficult for him to keep posted upon momentous questions and national happenings. This raises another problem—

What shall the business man read ?

Of magazines there are no end,—fiction magazines, technical magazines, professional magazines, each elbowing its way to the reader's notice. Very entertaining or instructive or educative the respective classes may be, but the magazine that combines all of these qualities, that fills the requirements of a broad, high-class, periodical for the business man's library, is unique. Canada has such a publication in MacLean's Magazine.

It differs entirely from any other Magazine. Technically it should not be called a Magazine. It is a high-grade national monthly newspaper. It aims to publish the latest information from the pens of the best available writers of the Political, Social and Business development in Canada and throughout the world. It is just what is needed to fit with the business man's hobbies and keep bright the culture of his information.

The fiction also from the strongest Canadian writers is so select that the busy man can afford the time he thus spends fascinated by the lure of romance and adventure. Lastly, such a budget of literature meets the demand of the business man's home in that it is an educative, sterling, broad-minded oracle for the family circle.

Secure a copy from your nearest newsdealer. You'll enjoy its pages from cover to cover. Take a copy home to-day—The price is twenty cents.

The MacLean Publishing Co.

Limited

143 University Avenue, TORONTO, Canada

The Herbert Morris Crane & Hoist Co., Ltd., Toronto, have sent us a copy of bulletin A-10, dealing with type "S-4" hand operated overhead travelling cranes. Views are shown of several installations, including one of the Electric Light Co. plant at Sarnia, Ont. The bulletin also contains a diagram, with table, giving the principal dimensions of each size. The Company have issued their monthly stock list of chain blocks.

The Gardner Horizontal Single-cylinder Air Compressors are described in circular A-C.5, which has been issued by the Gardner Governor Co., Quincy, Ill. The design and construction of the compressor is dealt with in detail, together with illustrations, one of which shows a cross section of the compressor, with explanatory notes. The bulletin concludes with tables giving the principal dimensions of each size, flow of air and compressed air data, etc.

The Canadian Allis-Chalmers, Ltd., Toronto, have sent us a copy of their new catalog No. 133, devoted to mechanical power transmission machinery. The catalog contains illustrations and descriptive matter of practically everything relating to transmission machinery, too numerous to mention in detail. The tables of dimensions and other data accompanying each item are sufficiently complete for the use of purchasing agents and others. An interesting feature is the collection of tables, etc., selected from engineers' hand books, all useful for transmission calculations. The catalog is attractively bound in stiff cloth covers, with clean cut illustrations on almost every page. The reading matter is well arranged and comprehensive. Copies will be gladly sent to interested readers.

"Treatment of Boiler Feed Water" is the title of a neat booklet issued by the Dearborn Chemical Co., of Canada, C.P.R. Building, Toronto, Ont. Attention is drawn in this publication to the fact that water used as steam boiler feed may and does contain a variety of substances in varying qualities, and that, therefore, proper remedial agents to deal with the individual constituents are necessary, together with the choice of reagents to prevent the formation of equally deleterious substances to those originally existent. The Dearborn methods of, and preparations for, treating water for boiler feed are explained and discussed, from which it will be noted that a combined theoretical and practical application of chemistry together with an intimate investigation of plant operating conditions, is the basis from which Dearborn treatment is successfully effected.

Graphite?
Of Course.
For the Boiler?
By All Means.

But
Be Sure It Is

Made and Sold for Twenty-Five Years.

DIXON'S

The Pioneer

BOILER GRAPHITE

That Has Been on the Market for Twenty-Five Years, and Which Is Made and Sold by the Company that Has Been Studying Graphite and Its Applications for Eighty-Six Years

This Booklet—No. 222—Tells All You Need To Know About Graphite Boiler Cleaning. Write For It Today.

Made in JERSEY CITY, N.J., by the

Joseph Dixon Crucible Company

ESTABLISHED 1827

109

HINTS TO BUYERS

Mueller Pressure Reducing and Regulating Valves

Give accurate and absolute control of pressures of water, steam, air, gas, oil, carbonic and acetylene gases—in fact, all kinds of pressures. Their efficiency is firmly established. Manufactured under Canadian patent No. 127,566. Address:

H. Mueller Mfg. Company, Ltd.
Sarnia - Ontario

LUBRICATING OILS

Canadian Oil Companies, Limited

TORONTO MONTREAL ST. JOHN
HALIFAX WINNIPEG
REGINA CALGARY
NELSON

Lanco Balata Belting

can be used under almost any conditions except those of heat. It is made of 38-oz. duck, woven as tightly as it is possible to weave it, and impregnated with pure Balata Gum. Lanco Balata gives unequalled length of service. Write for belting book, "The Main Drive."

Federal Engineering Co., Ltd.
Toronto Montreal

Don't Use Boiler Compounds

Which are always injurious to boilers and valves.

We guarantee an absolute Metal Clean Boiler, when there is sufficient exhaust steam. Get the Nobis habit around your power plant.

Best References

The Nobis Engineering Co.

GUSTAV NOBIS
Rheydt, Germany
ENGINEER, MANUFACTURER AND HEATING CONTRACTOR
Founded 1880

Heating Engineers and Contractors
329 King St. West, Toronto
Phone Adelaide 3669.

Notice to Stationary Engineers

Everyone operating a Stationary Steam Plant of 50 h.p. or over, in the Province of Ontario, must hold a Certificate from this Board. Anyone operating such a plant without a Certificate is liable to the penalties set forth in the Stationary Engineers' Act

HON. J. S. DUFF,
Minister of Agriculture.

W. C. McGHIE,
Chairman of Board,
Parliament Buildings, Toronto

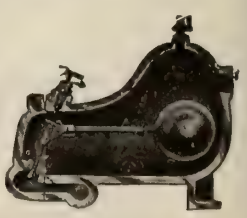
McDANIEL IMPROVED STEAM TRAP

FOR HIGH OR LOW PRESSURE.

Steam can't blow through. They have large discharge valves and cannot be flooded from sudden flushes of water.

MAY WE SEND ONE FOR TRIAL?

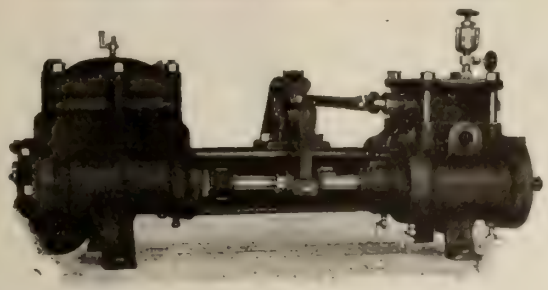
Reducing Valves, Pump Governors, Relief Valves, Exhaust Pipe Heads, Ejectors and Steam Separators. SEND FOR CATALOGUE.



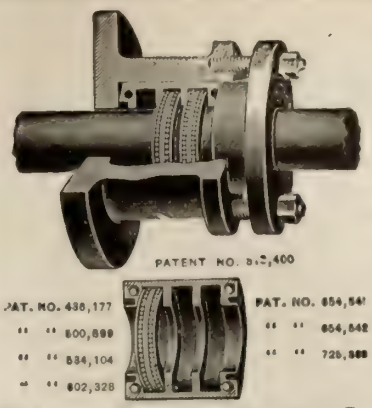
THE GARTH COMPANY
26 Craig St. MONTREAL, CAN.
WATSON & McDANIEL CO.,
No. 146 N. 7th St. PHILADELPHIA, Pa.

The advertiser would like to know where you saw his advertisement—tell him.

We manufacture Steam and Power Pumps, Condensers and Travelling Cranes



The Smart-Turner Machine Co., Ltd.
Hamilton, Canada



Why not Buy the Best, when in market for Packing?

HOLMES'

Metallic Packing

is Guaranteed 3 years

Lasts many times longer. 30 days trial. Less oil. No cutting. Easily applied to any Steam Engine, Air Compressor or Gas Engine. Satisfaction or no pay. Write us.

Holmes Metallic Packing Co., Wilkes-Barre, Pa.

BEATH CRANES CHAIN BLOCKS TROLLEYS OVERHEAD RUNWAYS

Solve Coal, Machinery and Merchandise Handling Problems.
Hand, Pneumatic and Electrically Operated

Tell us what you wish to do, and we'll suggest the proper equipment for you.

W. D. BEATH & SON, Limited
Engineers and Manufacturers
20-30 Cooper Ave, TORONTO
The A. M. Ellicott Co, 301 James St , Montreal Que.
Sole selling agents for the Province of Quebec

Eugene F. Phillips Electrical Works, Limited

MONTREAL CANADA

Bare and Insulated Electric Wire

Electric Light Line Wire. Incandescent or Flexible Cords.

Railway Feeder and Trolley Wire

Americanite, Magnite, Office and Annunciator Wire. Cables for Aerial and Underground Use.

HALIFAX TORONTO WINNIPEG VANCOUVER

REDUCE YOUR BELTING EXPENSE

Reasons Why

BECAUSE! It lasts longer than any other belt on the market.
BECAUSE! It slips just one-half that of any other belting.
BECAUSE! It will run equally well in damp, wet or a dry atmosphere.
BECAUSE! It is less affected by acid fumes and high temperatures than any other belting.
BECAUSE! It is uniform in thickness and runs true.
BECAUSE! Of its great strength—almost twice that of best oak tanned double leather.
BECAUSE! It requires much less attention than other styles of belting.
BECAUSE! The stretch comes out quickly and after taking up once or twice (according to load and nature of run), requires little or no more attention.
BECAUSE! It transmits more power than any other belting.

BY USING

"CAMEL HAIR" "CAMEL" BRAND BELTING

Sole Makers

F. Reddaway & Co.

MONTREAL, QUE.

ALSO

Exclusive Agencies where full stocks of "Camel Hair" Belting are carried, viz:—

A. R. Williams Mchry. Co., Ltd., Toronto, Ont.

A. R. Williams Mchry. Co. of Winnipeg, Ltd., Winnipeg, Man.

A. R. Williams Mchry. Co. of Vancouver, Ltd., Vancouver, B. C.

Comparative Tests

vs. Best Double Leather Belting

4-in. Best Double Leather broke at	4,900
4.in. "Camel Hair" broke at	6,866
6-in. Best Double Leather broke at	5,641
6-in. "Camel Hair" broke at	11,575
8-in. Best Double Leather broke at	11,271
8-in. "Camel Hair" broke at	14,000
10-in. Best Double Leather broke at	15,000
10-in. "Camel Hair" broke at	21,000

The advertiser would like to know where you saw his advertisement—tell him.

Why Chip It Out?

Why send men in to scurf that boiler, wasting valuable time and money, chipping at rock-hard scale? Don't you know there's a better method?

Use **Walker's Electric Boiler Compound** in your feed water. It will shift all that scale, keep the boiler clean and will not injure tubes, sheets or pumps.

We'll send you a barrel for trial. If it doesn't stop your chipping, we'll not charge you anything.

We carry a complete line of Power House supplies. Let us tell you about them.

The Electric Boiler Compound

COMPANY, LIMITED

Guelph, Ontario

Toronto Engineers Should Join The

Canadian Association Stationary Engineers

Toronto No. 1

Meets on the 2nd and 4th Wednesdays in Foresters' Hall, 22 College Street.

Any engineer who wishes to join will be welcomed.

On the 4th Wednesday, from October to April, the meetings are open to all, and lectures are to be given by competent men on all subjects pertaining to engineering.

EMPLOYERS

who wish to secure competent men are invited to write the Secretary, who will be pleased, at all times, to get them good men.

JOHN W. MARR, Secretary
78 Duke Street

JOHN C. TWEEDALE, Pres. **C. MOSLEY, Treas.**

COAL

The freight and duty is the same on **high grade coal** as on medium or low grade coal.

Our **Lone Star** small coal is **guaranteed** to show 14,000 B.T.U.'s regularly.

Our specialty in Canada is high grade coal from Kentucky and West Virginia via Detroit.

Let us have your inquiries, and call on us if in need of **prompt shipment,** via Buffalo, Car Ferry or Detroit.

Ohio & Michigan Coal Co.

Mines in Ohio, West Virginia and Kentucky

Main Office
82-83-84 Home Bank Bldg., DETROIT, MICH.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS

TO THE STATIONARY ENGINEER WHO IS NOT A MEMBER OF THE C. A. S. E.

Have you ever seriously considered the necessity of mingling freely with your fellow-men whose life's occupation is the same as your own? If you have not, I would like to place before you the advantages which accrue to all thus associated.

We preach the doctrine of elevation of the Engineers through the medium of education.

By joining one of the subordinate associations of the C.A.S.E. you can gain knowledge of the character which is deemed so essential by successful practitioners of all the useful professions.

In all fairness I would ask you if an organization devoted to the calling at which you earn your daily bread is not entitled to special consideration from you?

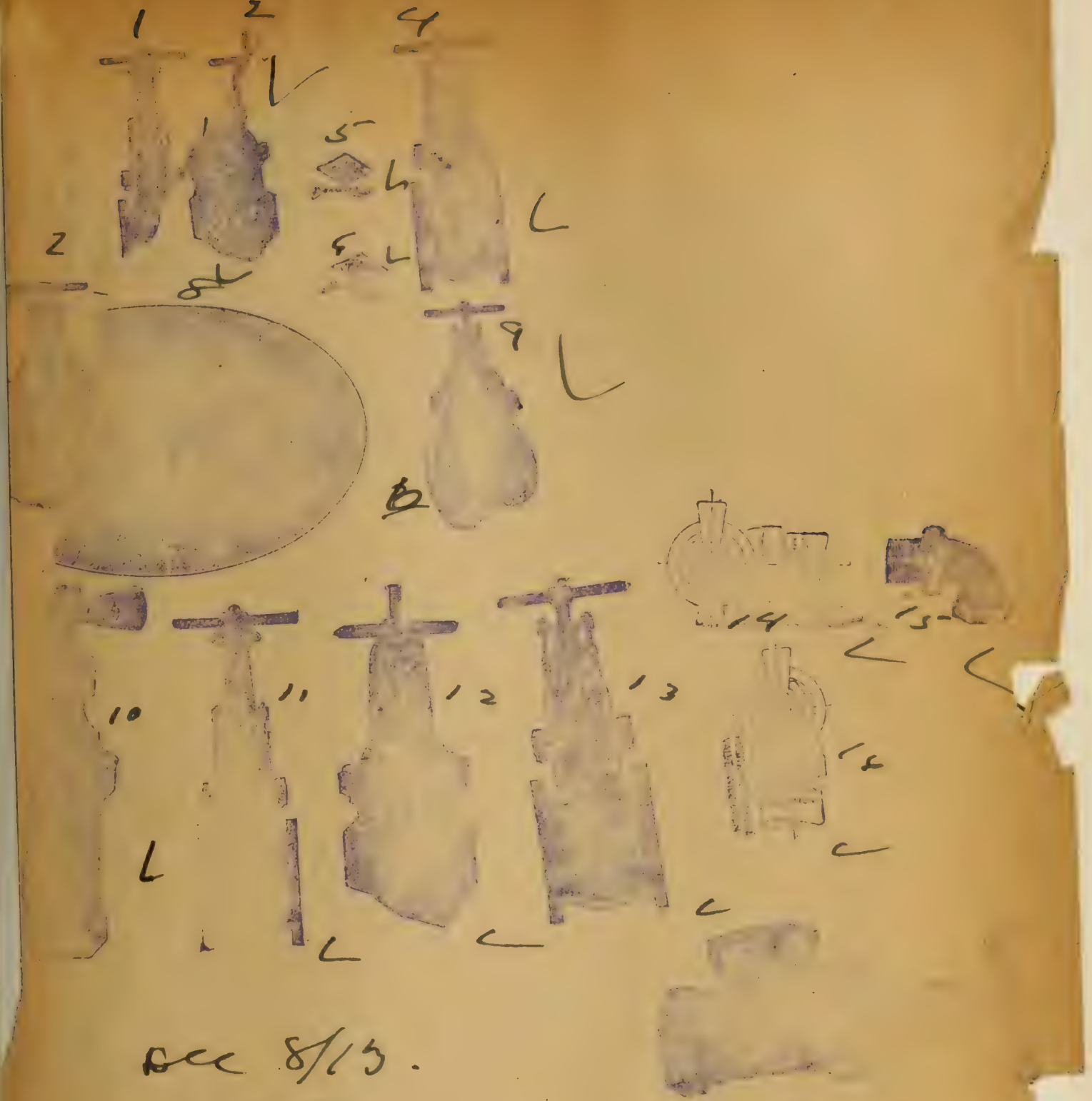
For further particulars write

A. KASTELLA

Executive Secretary

STRATFORD, - - - ONTARIO

The advertiser would like to know where you saw his advertisement—tell him.



Dec 8/13.

17 Cuts

delivered to

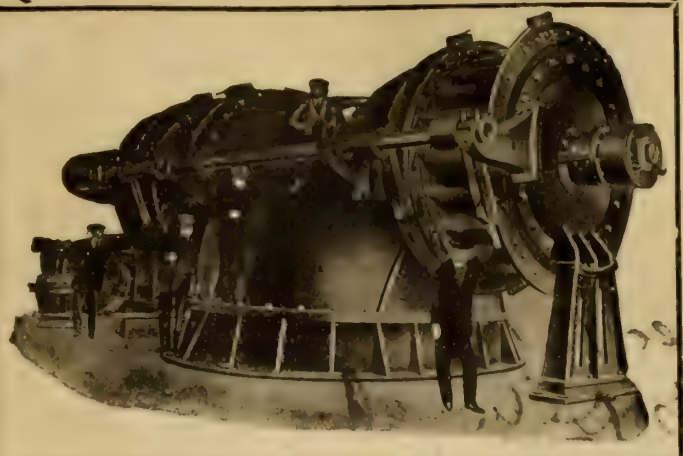
Jenkins Bros.

By. W Walker

WATER TURBINES
AND
GOVERNORS

All Sizes

Maximum Efficiency



All Heads

Ideal Control

ASK FOR PARTICULARS FROM

BOVING & CO. OF CANADA, LIMITED

164 BAY STREET, TORONTO.

Branch Office for British Columbia, 448 Seymour St., Vancouver

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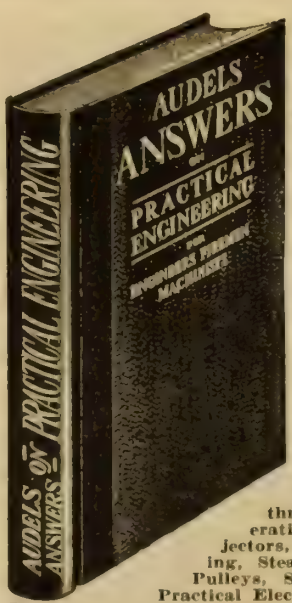
THE
CANADIAN CASUALTY
AND
BOILER INSURANCE
COMPANY

is Company makes a specialty of in-ecting boilers under construction, a issues an official Certificate of In-ection, as required by the Laws of tario which came into force on the

NENTAL LIFE BUILDING
TORONTO

atour, neer. John J. Durance, Manager.

Phone Main 6941



ENGINEERS

THIS book deals largely with the foundation principles which govern the practice of steam engineering. Nothing so soon condemns the applicant as want of knowledge of the every day practice and simple laws relating to the care and management of a steam plant.

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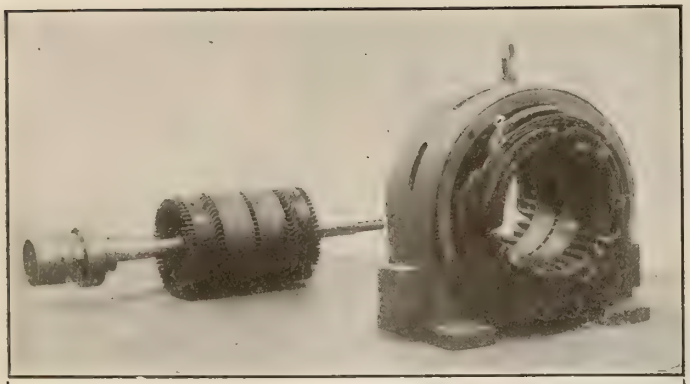

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The same quantity of oil should be delivered per stroke. That's the ideal of effective cylinder lubrication, and

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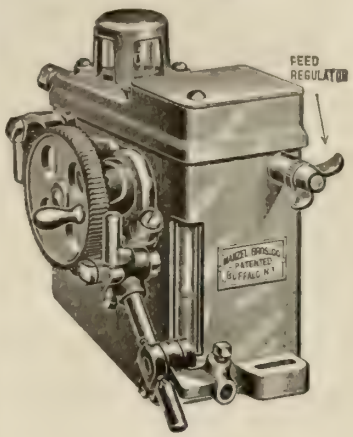

Because the "Manzel" delivers just the right quantity of oil under all conditions, it will cut your lubricating costs from 30 to 60 per cent.

We want you to try one for 30 days, at our expense. If it doesn't come right up to specifications, you needn't keep it.

So write us now.

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When GREASE Gives More Uniform Lubrication, Is Better and Much Cheaper?

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for Feeding Back Hot Condensed Water direct to Boiler,
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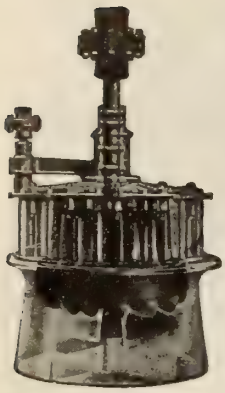

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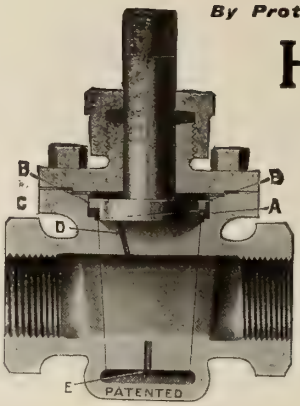

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FURTHERMORE, the plug is balanced and held in place by the pressure when open, and when closed it is locked in the seat by our patent wedging cam, insuring freedom from friction in seat while the plug is turning. This makes the Homestead the quickest acting, simplest made, easiest to operate and most durable ever known.

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The Best Practice in Power Plants

THE new book of Hoists shows modern boiler room installation for handling coal by electric hoist and trolley. Under 4,000 lb. loads these hoists travel 350 feet per minute from bunkers to furnace, controlled from the floor or from a trailer cage.

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EACH BLOCK TESTED TO 50 PER CENT. OVERLOAD

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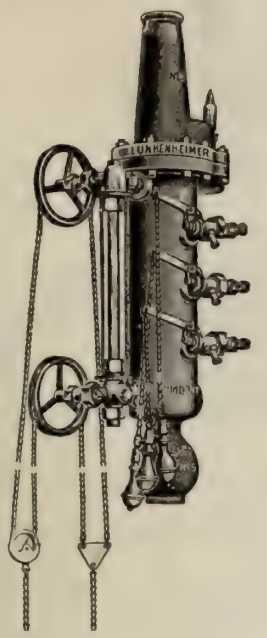

LUNKENHEIMER "VILIGANT" SAFETY WATER COLUMNS

will **prevent serious accidents** by automatically sounding an alarm, and thereby notifying the boiler attendant when the water in the boiler approaches the low or high danger limit.

By insuring a uniform water level, the "Vigilant" **effects greater economy** in the use of fuel, **obviates expensive repairs** and stoppages and **lengthens the life of the boiler.**

Only one strong, seamless copper float is used, and it is guaranteed not to collapse under 350 pounds of pressure per square inch.

The material used for the body and top is a high grade iron of close grain and great strength, while **all parts subjected to wear** and which are renewable, are made of a good bronze composition containing a large percentage of copper and tin. The columns are guaranteed for working pressures up to 250 pounds and are made in all sizes suitable for various types of boilers.

Specify and insist upon securing genuine **Lunkenheimer make.** Do not accept substitutes,—they are never as good as the genuine.

"MOST supply houses sell them—yours CAN—if they DONT or WONT—tell US."

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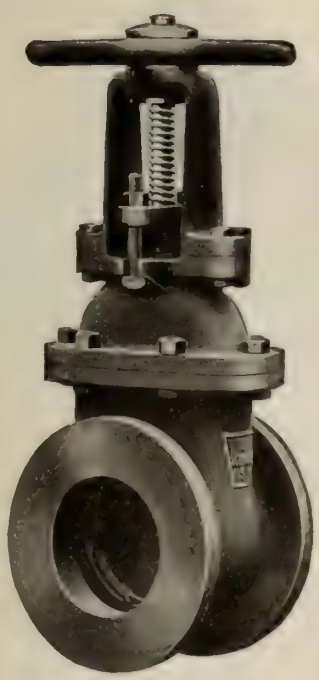
KERR GATE VALVES



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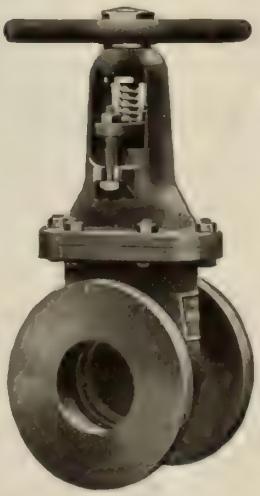

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Symmetrical Design.

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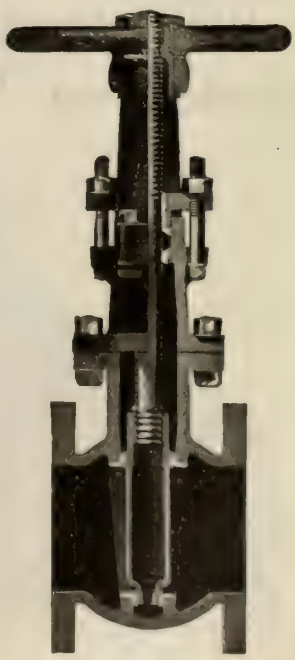

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Walkerville, Ontario

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Wasted Condensation is Wasted Money!

It is very important that condensation should be handled in the most efficient way in your steam plant.
The old pump method is inefficient and wasteful.
Let us send you a

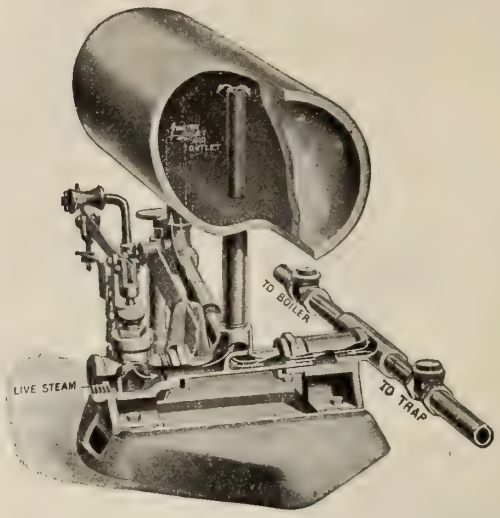
Morehead
Back to Boiler
SYSTEM

on our absolute guarantee basis to test in your own plant at your own convenience.

Simply send us your conditions, heating, drying, cooking, etc., and we will send a trap to suit conditions.

We make several different combinations—Vacuum, Condenser, Return and Non-Return Traps. Say which type.

By comparing results with those of your pump you will find that the **Morehead System cuts your fuel bills in two; saves excessive repair bills and gives a much more efficient heating system.**



Every ounce of the Condensation in Steam Lines goes back to the Boiler with practically no drop in temperature.

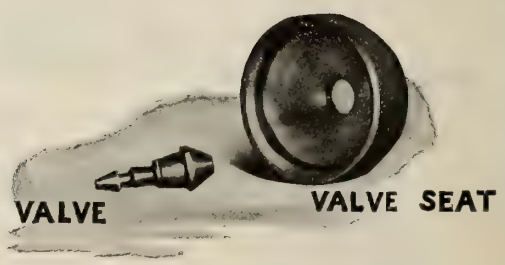
Morehead Traps have proven their superiority by actual service.

You simply cannot afford to be without our up-to-the-minute system.

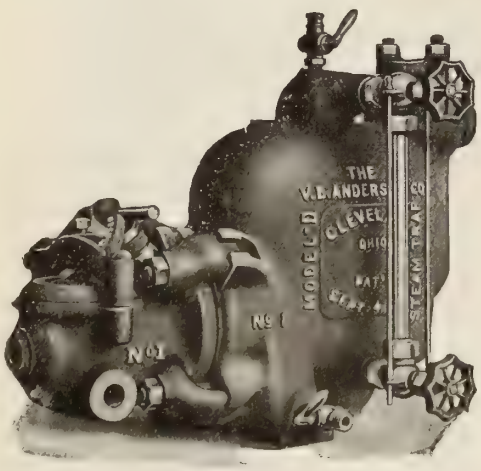
Ask for booklet.

Canadian Morehead Mfg. Co., Ltd. WOODSTOCK ONTARIO

"Just Change these two Parts"



that's all you have to do to suit the



Anderson Model "D" Steam Trap

to any pressure whatever.

Think of the convenience of it! Maybe you have a large plant, and steam at a bunch of different pressures. You can put an "Anderson" to drain an exhaust heating coil or ship the **same trap** over to drip your 120-lb. steam mains, just by changing the valve. It means economy to you, to specify the "Anderson" when you're buying steam trap equipment.

Besides this special feature, the "Anderson" is the sort of trap that's put on the line to stop there. It's built of the best materials in the best manner, and is designed to perform its duties continuously—year in year out.

Let us send you our book. It tells you all the other interesting features.

The V. D. ANDERSON CO., 1935 West 95th St., Cleveland, Ohio.

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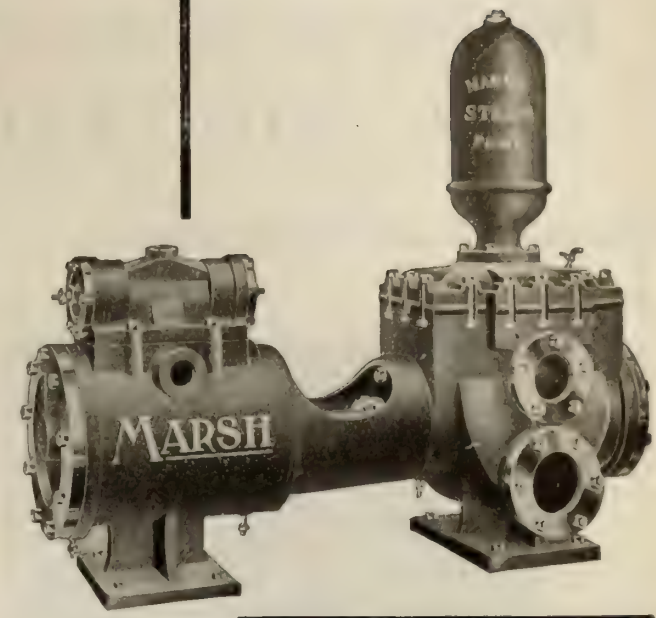
The Pump with the Self-governing Steam Valve

Note the extreme simplicity in construction and the absence of outside valve motion. There is practically nothing to get out of order. Nearly all the wearing parts are made of phosphor bronze instead of common brass, including piston rod, water cylinder lining and valve seats.

The steam valve is self-governing and admits only just enough steam to do the required work. The pump cannot short-stroke, race or pound under the most severe conditions.

115,000 in successful operation.

Ask for Catalog No. 18



American Steam Pump Company
BATTLE CREEK, MICH.

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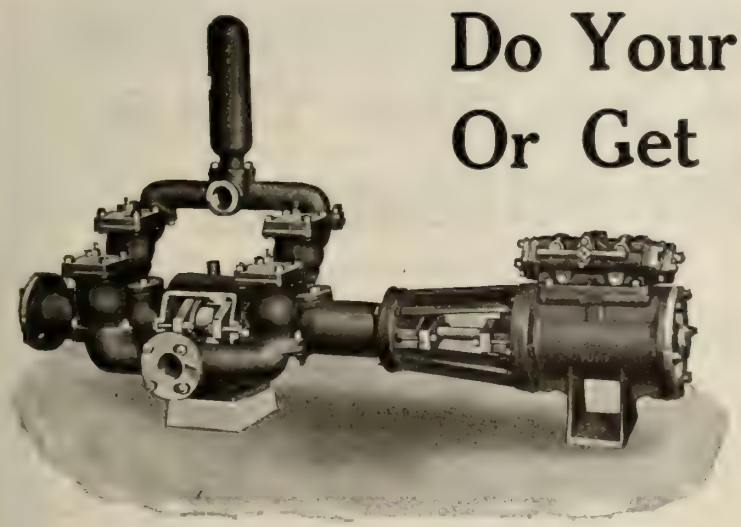
Do Your Pumps Ever Knock Or Get Air Bound?



The Bawden Pump overcomes all the difficulties found in other pumps because it is operated differently by the Bawden Patent Valve which is impossible to short stroke or tie up. It is automatically cushioned so it will not bang even when suction pipes are disconnected, and is designed so it cannot get air bound.

Pumps for all purposes.

WRITE FOR CATALOG AND LEARN WHY WE ARE EQUIPPING SO MANY LARGE PLANTS
DEMONSTRATIONS AT OUR PLANT WILL PROVE ALL WE CLAIM FOR OUR PUMPS

¶ Bawden Pumps are manufactured in an up-to-date factory equipped with the best machinery. They are of the newest and best design to meet modern steam pressures and conditions. The water valves are heavier and have no screw seats.

¶ There are no outside rods to stick, get out of adjustment or keep oiled. It will cost less to operate and maintain because it uses less steam and has less packing, and there is absolutely nothing in the steam end to go wrong.

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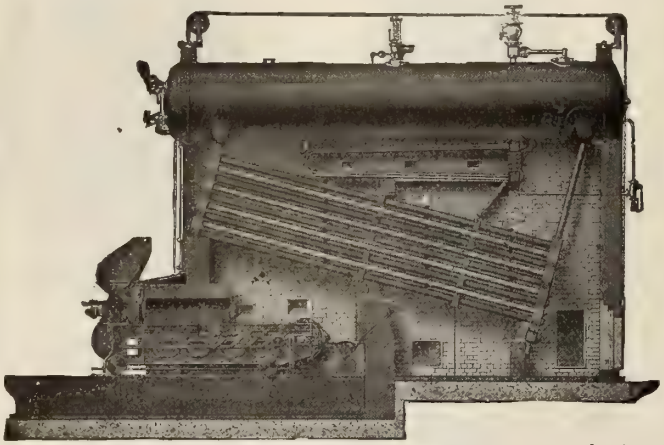

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and **ELECTRIC CRANES**

Our Book "STEAM" sent on request

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The Babbitt Metal without a fault.

Harris Heavy Pressure

Makes sunshine for the Engineer and Machinist. It is a High-grade Babbitt at a medium price, recognized as the best Babbitt Metal for all general machinery bearings, and answers in

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If your dealer cannot supply you order direct from our nearest factory.

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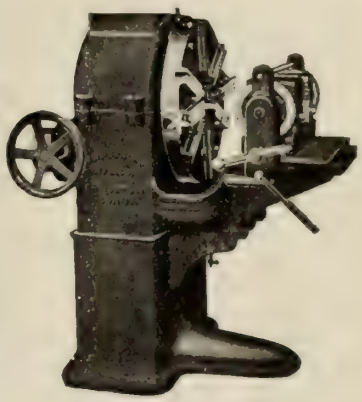

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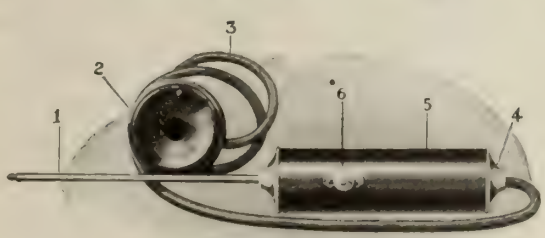

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Graton & Knight Mfg. Co., Worcester, Mass.

Patents.
Rowland Brittain, Vancouver, B.C.

Penstocks.
Can. Allis-Chalmers, Ltd., Toronto.
Boving & Co., of Canada, Limited, Toronto.

Pillow Blocks.
Can. Bond Hanger & Coupling Co., Alexandria.
Elmira Machinery & Transmission Co., Elmira, Ont.

Pipe Bending.
Nobis Engineering Co., Toronto.

Pipe Coils.
National Pipe Bending Co., New Haven, Conn.
York Mfg. Co., York, Pa.

Pipe Threading and Cutting Machines (Hand, Belt and Motor).
Oster Mfg. Co., Cleveland, O.

Pipe, Steel.
Can. Allis-Chalmers, Ltd., Toronto.
Boving & Co., of Canada, Limited, Toronto.
E. Leonard & Sons, London, Ont.

Pipe (Second-Hand).
Imperial Waste & Metal Co., Montreal.

Pipes, Water.
Can. Allis-Chalmers, Ltd., Toronto.
Boving & Co., of Canada, Limited, Toronto.
Pacific Coast Pipe Co., Vancouver, B. C.

Piping and Fittings.
Frick Co., Waynesboro, Franklin Co., Pa.
Jas. Morrison Brass Mfg. Co., Toronto.
York Mfg. Co., York, Pa.

Piping, Steam.
Babcock & Wilcox, Montreal.
Imperial Waste & Metal Co., Montreal.

Plate Work.
Can. Allis-Chalmers, Ltd., Toronto.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

Polish, Metal.
G. W. Hoffman, Indianapolis.

Power Pumps.
American Steam Pump Co., Battle Creek, Mich.
W. H. Allen Son & Co., Bedford, Eng.
Bawden Machine Co., Ltd., Toronto.
Boving & Co., of Canada, Limited, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Can. Allis-Chalmers, Ltd., Toronto.
Darling Bros., Montreal.
Goldie & McCulloch Co., Galt.
Goulds Pump Co., Montreal.
E. Leonard & Sons, London, Ont.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.
Waterous Engine Works Co., Brantford.
Canadian H. W. Johns-Manville Co., Ltd., Toronto.
Garlock Packing Co., Hamilton, Can.

Power Transmission Machinery.
American Pulley Co., Philadelphia.
Can. Bond Hanger & Coupling Co., Alexandria, Ont.
Can. Fairbanks-Morse Co., Montreal.
Elmira Machinery & Transmission Co., Elmira, Ont.
Engineering Works of Canada, Ltd., Montreal.
Goldie & McCulloch Co., Galt.
Jeffrey Manufacturing Co., Columbus.
Jenckes Machine Co., Sherbrooke, Que.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Waterous Engine Works Co., Brantford.
Siemens Co. of Canada, Ltd. Montreal.

Pulleys.
American Pulley Co., Philadelphia.
Can. Fairbanks-Morse Co., Montreal.
Elmira Machinery and Transmission Co., Elmira, Ont.
Jeffrey Manufacturing Co., Columbus.
Waterous Engine Works Co., Brantford.

Pulp Mill Machinery.
W. H. Allen Son & Co., Bedford, Eng.
The Bawden Machine Co., Toronto.
Escher, Wyss & Co., Toronto.
Jeffrey Manufacturing Co., Columbus.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford.

Pumping Machinery.
American Steam Pump Co., Battle Creek, Mich.
Boving & Co., of Canada, Limited, Toronto.
Bawden Machine Co., Ltd., Toronto.
Can. Allis-Chalmers, Ltd., Toronto.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.
Waterous Engine Works Co., Brantford.

Pumping Machinery, Electrical.
W. H. Allen Son & Co., Bedford, Eng.
Bawden Machine Co., Ltd., Toronto.
Jeffrey Manufacturing Co., Columbus.

Pump Governors and Regulators.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
C. A. Dunham Co., Toronto.
G. M. Davis Regulator Co., Chicago. Ill.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
Smart - Turner Machine Co., Ltd., Hamilton.
Watson & McDaniel Co., Philadelphia.

Pump Strainers.
Canadian Steam Boiler Equipment Co., Toronto.
Liberty Mfg. Co., Pittsburgh, Pa.

Pumps, Air.
W. H. Allen Son & Co., Bedford, Eng.
American Steam Pump Co., Battle Creek, Mich.
Boving & Co., of Canada, Limited, Toronto.
Can. Allis-Chalmers, Ltd., Toronto.
Can. Fairbanks-Morse Co., Montreal.
E. Leonard & Sons, London, Ont.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.

Pumps, Contractors'.
W. H. Allen Son & Co., Bedford, Eng.
William Hamilton Co., Ltd., Peterborough.

Pumps, Hand and Power.
S. F. Bowser & Co., Inc., Toronto.

Pumps, Centrifugal.
Boving & Co., of Canada, Limited, Toronto.
Can. Allis-Chalmers, Ltd., Toronto.
Engineering Works of Canada, Ltd., Montreal.
Canadian Boving Co., Toronto.
Escher, Wyss & Co., Toronto.
Hare Eng. Co., Toronto.
E. Leonard & Sons, London, Ont.
John McDougall Caledonian Iron Wks. Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.
Waterous Engine Works Co., Brantford.

Pumps, Geared, Compound.
American Steam Pump Co., Battle Creek, Mich.
The Bawden Machine Co., Toronto.
Can. Allis-Chalmers, Ltd., Toronto.
Can. Fairbanks-Morse Co., Montreal.
E. Leonard & Sons, London, Ont.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.

Pumps, Hydraulic, Pressure.
American Steam Pump Co., Battle Creek, Mich.
Bawden Machine Co., Ltd., Toronto.
Can. Allis-Chalmers, Ltd., Toronto.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.

Pump Leathers.
Graton & Knight Mfg. Co., Worcester, Mass.

Pumps, Oil.
The Bawden Machine Co., Toronto.
S. F. Bowser & Co., Inc., Toronto.
Can. Detroit Lubricator Co., Walkerville, Ont.
The Lunkenheimer Co., Cincinnati, O.
Manzel Cros. Co., Buffalo, N.Y.
Smart - Turner Machine Co., Ltd., Hamilton.

Pumps, Steam.
American Steam Pump Co., Battle Creek, Mich.
W. H. Allen Son & Co., Bedford, Eng.
Bawden Machine Co., Toronto.
S. F. Bowser & Co., Inc., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Can. Allis-Chalmers, Ltd., Toronto.
Darling Bros., Montreal.
C. A. Dunham Co., Toronto.
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.

Pumps, Triplex.
William Hamilton Co., Ltd., Peterborough.

Pumps, Vacuum.
American Steam Pump Co., Battle Creek, Mich.
W. H. Allen Son & Co., Bedford, Eng.
The Bawden Machine Co., Toronto.
Boving & Co., of Canada, Limited, Toronto.
Canadian Steam Boiler Equipment Co., Toronto.
Hare Eng. Co., Toronto.
C. A. Dunham Co., Toronto.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.

Pump Tank, Receiver.
American Steam Pump Co., Battle Creek, Mich.
Can. Allis-Chalmers, Ltd., Toronto.

Pyrometers.
Jas. Morrison Brass Mfg. Co., Toronto

Rails (Relaying).
Imperial Waste & Metal Co., Montreal

Radiator Air Vents.
Jas. Morrison Brass Mfg. Co., Toronto.

Reboilers.
Frick Co., Waynesboro, Franklin Co., Pa.

Reels.
American Pulley Co., Philadelphia.

Refrigerator Doors, Windows, Etc.
Jones Cold Store Door Co., Hagerstown, Ind.

Refrigerating Engineers.
Arctic Ice Machine Co., Canton, Ohio.
Chas. Bishop, Montreal.

Refrigerating Machinery.
Arctic Ice Machine Co. Canton, Ohio.
Frick Co., Waynesboro, Franklin Co., Pa.
Linde British Refrigeration Co., Montreal.
Linde Can. Refrigeration Co., Montreal.
Vilter Mfg. Co., Milwaukee, Wis.
York Mfg. Co., York, Pa.

Regulators, Pressure.
C. A. Dunham Co., Toronto.
Jas. Morrison Brass Mfg. Co., Toronto.
Ohio Brass Co., Mansfield, Ohio.

Revolving Doors for Hardening Rooms.
Jones Cold Store Door Co., Hagerstown, Md.

Revolution Counters.
Maihak Indicator Agency, Montreal.

Rheostats.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co. Hamilton.
Siemens Co. of Canada, Ltd. Montreal.

Roofings—Asbestos and Wool Felts
Canadian H. W. Johns-Manville Co., Ltd., Toronto.

Rope Preservative.
Cling Surface Co., Buffalo.

Rotary Converters.
Can. Fairbanks Morse Co., Montreal.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Siemens Co of Canada, Ltd. Montreal.

Rubber Hose.
Garlock Packing Co., Hamilton, Ont.
Liberty Mfg. Co., Pittsburg, Pa.
Quaker City Rubber Co., Philadelphia.

Rubber Molds.
The Bawden Machine Co., Toronto.

Safes.
Can. Fairbanks-Morse Co., Montreal.
Goldie & McCulloch Co., Galt.

Safety Valves.
Can. Fairbanks-Morse Co., Montreal.
Lunkenheimer Co., Cincinnati, O.

Sash Pulleys.
American Pulley Co., Philadelphia.

Separators, Oil, Steam and Ammonia.
Frick Co., Waynesboro, Franklin Co., Pa.

Shafting.
Elmira Machinery and Transmission Co., Elmira.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Wks. Co., Brantford

Shaking and Dumping Grates.
Babcock & Wilcox, Montreal.
Can. Steam Boiler Equipment Co., Toronto.
Hare Eng. Co., Toronto.
Waterous Engine Wks. Co., Brantford

Sign Receptacles
Duncan Electrical Co., Montreal.

Smoke Consumers.
Canadian Steam Boiler Equipment Co., Toronto.

Smoke Boxes, Stacks.
Babcock & Wilcox, Montreal.
Can. Allis-Chalmers, Ltd., Toronto.
E. Leonard & Sons, London, Ont.
Waterous Engine Wks. Co., Brantford

Smokeless Furnaces.
Jones Underfeed Stoker Co., Toronto.
Murphy Iron Wks. ,Detroit, Mich.
Geo. H. Tod, Manning Chambers, Toronto.

Soot Cleaners.
Vulcan Tube Cleaning Systems, Ltd., Montreal.

Special Machinery.
W. H. Allen Son & Co., Bedford, Eng.
The Bawden Machine Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Waterous Engine Wks. Co., Brantford

Sprocket Chain Attachments.
Waterous Engine Wks. Co., Brantford

Spur Wheels.
Can. Fairbanks-Morse Co., Montreal.
Waterous Engine Wks. Co., Brantford

Stand Pipes, Steel.
Can. Allis-Chalmers, Ltd., Toronto.
William Hamilton Co., Ltd., Peterborough.

Steam Separators.
Can. Fairbanks-Morse Co., Montreal.
Can. Allis-Chalmers, Ltd., Toronto.
Darling Bros., Montreal.
C. A. Dunham Co., Toronto.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
Smart - Turner Machine Co., Ltd., Hamilton.
Watson & McDaniel Co. Philadelphia
Montreal.
Arctic Ice Machine Co., Canton, Ohio.

Steam Specialties.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Can. Allis-Chalmers, Ltd., Toronto.
Darling Bros., Montreal.
C. A. Dunham Co., Toronto.
Hare Eng. Co., Toronto.
Liberty Mfg. Co., Pittsburg, Pa.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co. Toronto.
Ohio Brass Co., Mansfield, O.
Penberthy Injector Co., Windsor.
Watson & McDaniel Co. Philadelphia
Vulcan Tube Cleaning System, Ltd., Montreal.

Steam Traps.
V. D. Anderson Co., Cleveland, O.
Can. Fairbanks-Morse Co., Montreal.
Can. Allis-Chalmers, Ltd., Toronto.
Darling Bros., Montreal.
G. M. Davis Regulator Co., Chicago.
C. A. Dunham Co., Toronto.
Elliott Co., Pittsburgh, Pa.
Hare Eng. Co., Toronto.
Can .Morehead Mfg. Co., Woodstock,
Nobis Engineering Co., Toronto.
Schneider & Helmecke, Madgeburg, Germany.
Watson & McDaniel Co., Philadelphia

Steam Turbine Blowers.
Hare Eng. Co., Toronto.
International Engineering Works, Ltd., Amherst, N. S.

Steam Turbine Generators.
W. H. Allen Son & Co. Bedford, Eng.
Hare Eng. Co., Toronto.
International Engineering Works, Ltd., Amherst, N. S.
Siemens Co. of Canada, Ltd. Montreal.

Steam Turbine Pumps.
W. H. Allen Son & Co., Bedford, Eng.
Hare Eng. Co., Toronto.

Steel Tanks.
William Hamilton Co., Ltd., Peterborough.

Stokers.
W. H. Allen Son & Co., Bedford, Eng.
Ed. Bemis & Co., Little Hulton, Bolton, Eng.
Hare Engineering Co., Ltd., Toronto.
Jones Underfeed Stoker Co., Toronto.
Murphy Iron Wks., Detroit, Mich.
Geo. H. Tod, Manning Chambers, Toronto.

Strainers.
W. H. Allen Son & Co., Bedford, Eng.
Elliott Co., Pittsburg, Pa.

Superheaters, Steam.
Babcock & Wilcox, Montreal.

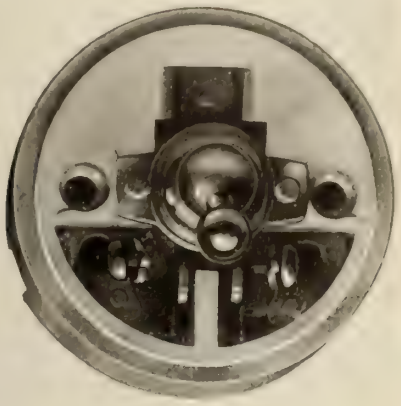
Switchboards, Light and Power.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.
Monarch Electric Co., St. Lambert, Que.
Siemens Co. of Canada, Ltd. Montreal
Lunkenheimer Co., Cincinnati, O.

A fine switch,—

Switched closed

The Duncan New Code Tumbler Switch

Especially designed to meet every requirement of the Canadian Fire Underwriters, and each switch bears their approval.



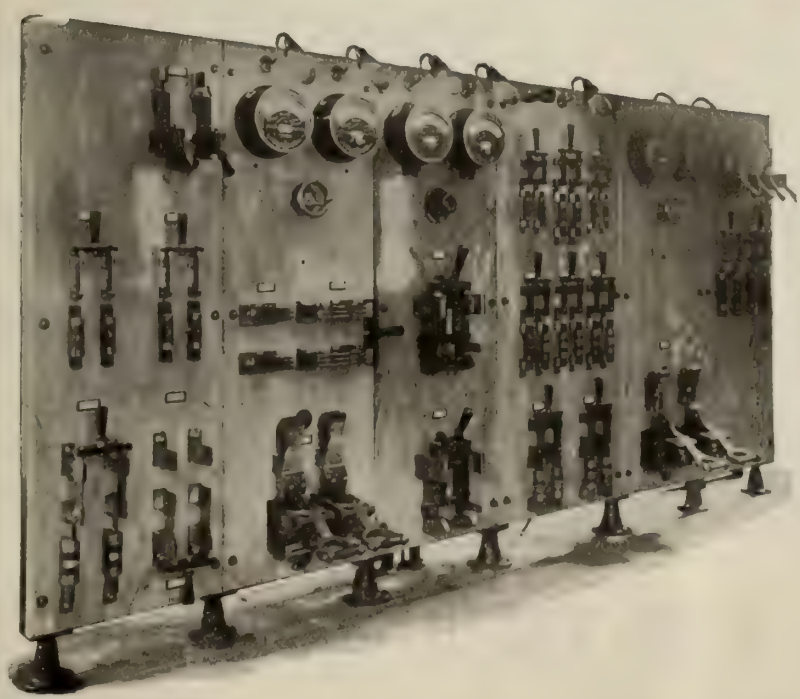
Switch open

Get your dealer to supply you with one or two for trial.

The Duncan Electrical Company, Limited
Montreal

Makers of Electrical Supplies of Duncan Quality

MONARCH ELECTRIC CO., Limited
ST. LAMBERT, P. Q., District of Montreal



Switch

Board

Specialists

The advertiser would like to know where you saw his advertisement—tell him.

Switches and Switch Boxes.
Canadian General Electric Co., Limited, Toronto.
Canadian Westinghouse Co., Hamilton.
Duncan Electrical Co., Montreal.
Monarch Electric Co., St. Lambert, Que.
Orenstein-Arthur Koppel Co., Pittsburg.
Siemens Co. of Canada, Ltd. Montreal.

Tachographs.
Maihak Indicator Agency, Montreal.

Tachometers.
Maihak Indicator Agency, Montreal.

Tanks, Blow-off.
Can. Allis-Chalmers, Ltd., Toronto.
Darling Bros., Montreal.
John McDougall Caledonian Iron Wks. Montreal.

Tanks, Freezing, Storage and Water Cooling.
Frick Co., Waynesboro, Franklin Co., Pa.

Tanks, Oil.
S. F. Bowser & Co., Inc., Toronto.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Wks. Co., Brantford

Tanks, Water.
Can. Allis-Chalmers, Ltd., Toronto.
Pac. Coast Pipe Co., Vancouver, B.C.

Telephones.
Northern Electric & Mfg. Co., Limited, Montreal.

Transformers.
Can. Fairbanks-Morse Co., Montreal.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.
Monarch Electric Co., St. Lambert, Que.
Siemens Co. of Canada, Ltd. Montreal.

Transmission Machinery.
Can. Bond Hanger & Coupling Co., Alexandria, Ont.
Can. Fairbanks-Morse Co., Montreal.
Elmira Machinery & Transmission Co., Elmira, Ont.
Goldie & McCulloch Co., Galt, Ont.
Jeffrey Manufacturing Co., Columbus.
The John McDougall Caledonian Iron Works Co., Ltd., Montreal.
Waterous Engine Wks. Co. Brantford

Trucks, Factory.
Can. Fairbanks-Morse Co., Montreal.

Tube Cleaners.
Can. Allis-Chalmers, Ltd., Toronto.
Elliott Co., Pittsburgh, Pa.
Liberty Mfg. Co., Pittsburg, Pa.

Tube Cutters.
Liberty Mfg. Co., Pittsburg, Pa.

Tubes, Boilers.
Babcock & Wilcox, Montreal.

Tube Expanders.
Liberty Mfg. Co., Pittsburg, Pa.

Tungsten Lamps.
Can. Sunbeam Lamp Co., Toronto.
Can. Tungsten Lamp Co., Hamilton, Ont.
Canadian General Electric Co., Ltd., Toronto.
G. Lewis, Montreal.

Turbine Water Wheels.
W. H. Allen Son & Co., Bedford, Eng.
Canadian Boving Co., Hamilton.
Chas. Barber & Sons, Meaford, Ont.
Engineering Works of Canada, Ltd., Montreal.
Escher, Wyss & Co., Toronto.
Jenckes Machine Co., Sherbrooke, Que.
William Hamilton Co., Ltd., Peterborough.

Turbines, Steam.
Can. Allis-Chalmers, Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Engineering Works of Canada, Ltd., Montreal.
Escher, Wyss & Co., Toronto.
Hare Eng. Co., Toronto.
International Engineering Works, Ltd., Amherst, N.S.
Laurie & Lamb, Montreal.
John McDougall Caledonian Iron Wks. Montreal.

Turntables
Orenstein-Arthur Koppel Co., Pittsburg.

Unions.
Can. Fairbanks-Morse Co., Montreal.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.

Vacuum Governors.
Smart - Turner Machine Co., Ltd., Hamilton.
Canadian Steam Boiler Equipment Co., Toronto.
G. M. Davis Regulator Co., Chicago.

Vacuum Regulating Valves.
Canadian Steam Boiler Equipment Co., Toronto.
Darling Bros., Montreal.
Smart - Turner Machine Co., Ltd., Hamilton.

Vacuum Traps.
C. A. Dunham Co., Toronto.
Can. Morehead Mfg. Co., Woodstock, Ont.

Valve, Disk.
Durabla Mfg. Co., New York.
Goetze-Gasket & Packing Co., New Brunswick, N.J.

Valve, Reseating Machines.
Darling Bros., Montreal.

Valves.
Can. Allis-Chalmers, Ltd., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Canadian Steam Boiler Equipment Co., Toronto.
Frick Co., Waynesboro, Franklin Co., Pa.
G. M. Davis Regulator Co., Chicago.
Hare Eng. Co., Toronto.
Homestead Valve Mfg. Co. Pittsburg.
Jenkins Bros., Montreal.
Kerr Engine Co., Walkerville, Ont.
Liberty Mfg. Co., Pittsburg, Pa.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
Nobis Engineering Co., Toronto.
Ohio Brass Co., Mansfield, Ohio.
Watson & McDaniel Co. Philadelphia

Valves, Blow-off.
Can. Fairbanks-Morse Co., Montreal.
Elliott Co., Pittsburgh, Pa.
Engineering Specialties Co., Toronto.
Jenkins Bros., Ltd., Montreal.
Lunkenheimer Co., Cincinnati, O.
Watson & McDaniel Co. Philadelphia

Valves, Gates.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
Ohio Brass Co., Mansfield, Ohio.

Valves, Reducing.
Liberty Mfg. Co., Pittsburg, Pa.
Jas. Morrison Brass Mfg. Co., Toronto.
Ohio Brass Co., Mansfield, Ohio.
Watson & McDaniel Co. Philadelphia
H. Mueller Mfg. Co., Ltd., Sarnia, Ont.

Valves, Radiator.
Jenkins Bros., Ltd., Montreal.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
Ohio Brass Co., Mansfield, Ohio.

Valves, Throttle.
Can. Detroit Lubricator Co., Walkerville, Ont.
Lunkenheimer Co., Cincinnati, O.

Vaults & Vault Doors.
Can. Fairbanks-Morse Co., Montreal.
Goldie & McCulloch Co., Galt.

Ventilating.
Nobis Engineering Co., Toronto.

Voltmeters.
Canadian General Electric Co., Ltd., Toronto.
Canadian Westinghouse Co., Hamilton
Siemens Co. of Canada, Ltd. Montreal.

Washers, Leather.
Graton & Knight Mfg. Co., Worcester, Mass.

Waste and Wipes.
Imperial Waste & Metal Co., Montreal.

Water Columns, Gauges.
Elliott Co., Pittsburgh, Pa.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.
W. J. Wall, Montreal.

Water Hose.
Liberty Mfg. Co., Pittsburgh, Pa.

Water Level Regulators.
Hare Eng. Co., Toronto.

Water Lifters.
Watson & McDaniel Co. Philadelphia

Water Motors.
Elliott Co., Pittsburgh, Pa.

Water Purifiers, Softeners.
Babcock & Wilcox, Montreal.
Nobis Engineering Co., Toronto.

Water Wheels.
Chas. Barber & Sons, Meaford, Ont.
John McDougall Caledonian Iron Wks. Montreal.
William Hamilton Co., Ltd., Peterborough.

Whistles, Plain or Chime.
Lunkenheimer Co., Cincinnati, O.
Jas. Morrison Brass Mfg. Co., Toronto.

Wire, Bare and Insulated.
Canadian General Electric Co., Ltd., Toronto.
Eugene F. Phillips Electrical Works, Ltd., Montreal.

Wire, Magnet and Trolley.
Canadian General Electric Co., Ltd., Toronto.
Eugene F. Phillips Electrical Works, Ltd., Montreal.

Wire, Railway Feeder and Trolley.
Canadian General Electric Co., Ltd., Toronto.
Eugene F. Phillips Electrical Works, Ltd., Montreal.

Wrenches.
Greene, Tweed & Co., New York.

NEWTYPE BERGMANN LAMPS

(Tungsten Filament)

THE UNBREAKABLE KIND

Are now ready for delivery. We guarantee delivery to you in good condition.

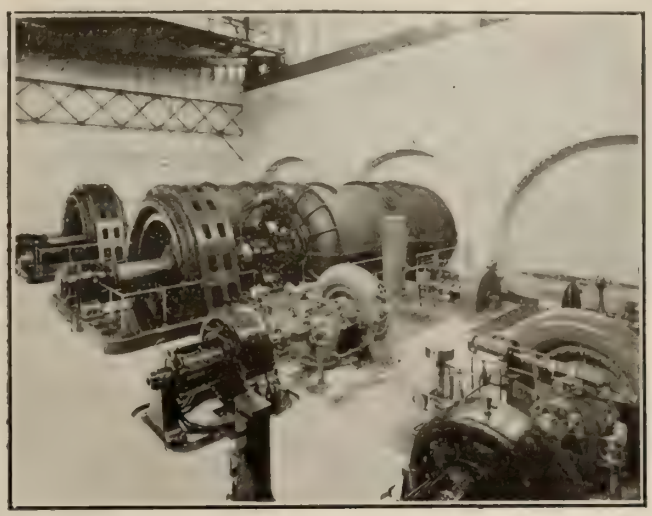
EXCLUSIVE CANADIAN DISTRIBUTOR:

P. H. KLEIN CO., Limited

Live Agents wanted all over Canada. 23-25 Dowd Street MONTREAL

ESCHER-WYSS & CO.

ENGINEERS

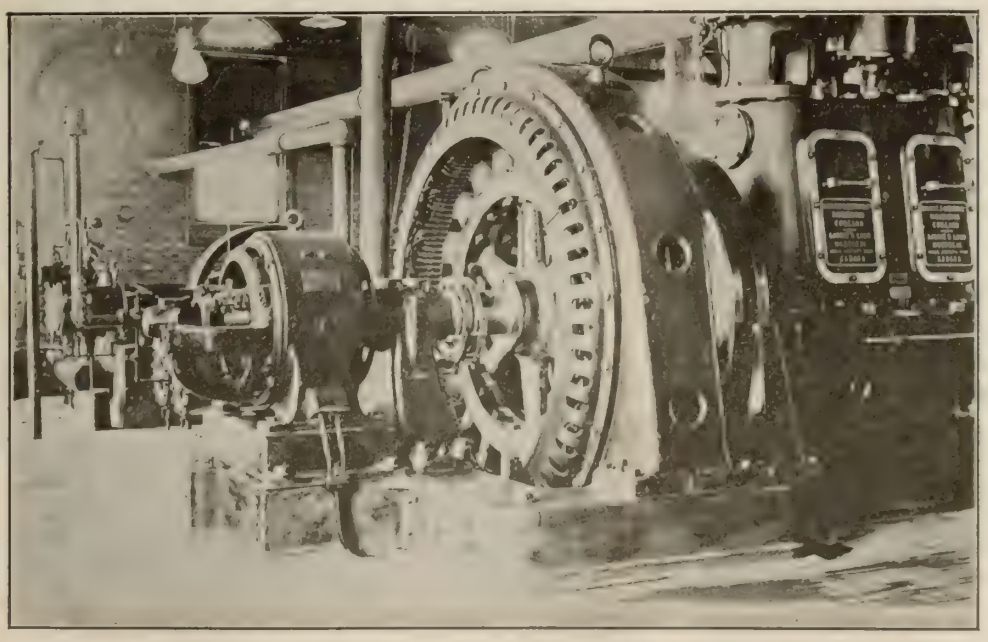


52,000 H.P. Plant Western Canada Power Co.

HYDRAULIC
STEAM
PUMPING
PLANTS

HEAD OFFICE FOR CANADA:
626 Coristine Bldg.,
MONTREAL, Que.

High Class Swedish Electrical Equipment



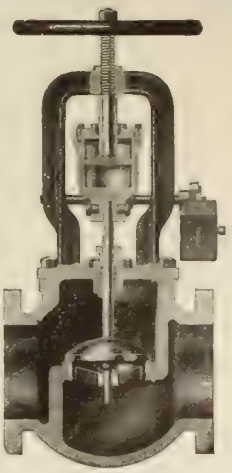
Owing to liberal design and the use of the best grade of Swedish Steel and Iron, we are able to guarantee and obtain the very best results.

350 K.V.A. 2200 Volt, 2 Phase, 60 Cycle, 360 R.P.M., AC. Generator connected to Bellis & Morcom High Speed Engine, supplied to Corporation of Wetaskiwin, Alta.

KILMER, PULLEN & BURNHAM, Limited
Head Office: TORONTO **Branch Office: MONTREAL**

The advertiser would like to know where you saw his advertisement—tell him.

In Case of Emergency



Globe and Angle Patterns

The Davis Class C Valve

has an outside oil dash pot where scale cannot form or the parts expand and stick. It has a counterweight lever which you can see move with the disc and which you can use to test by hand at any time. The disc and seat are renewable. This is the most trustworthy automatic emergency valve made and we want to send you full description and list of users. Write us.

WHEN an internal rupture occurs in one of the boilers in your battery you want that particular boiler to be automatically shut down and not your entire plant.

It is supposed that any Stop and Check Valve will do that—*if it is not stuck*. But there is the rub. Unless you have a dependable valve, of proper design, that will *always work*, you are sure to have trouble when an emergency occurs.

You can't afford to trust a valve with an internal steam dash pot and no indicator. The chances are that it will be stuck when called upon to act and you won't know it until too late.

G. M. Davis Regulator Co.

Established 1875

434 Milwaukee Ave., Chicago

New York Philadelphia Boston Pittsburgh St. Louis San Francisco

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Figure 1

Typical Westinghouse Switchboard

For a Large Street Railway System

Figure 1 shows a 58 panel switchboard for the control of the following initial equipment. Two 2500 kva., 2300 volt, 2 phase, 60 cycle generators; three 500 kw, 600 volt D. C. 6-phase, 60 cycle rotary converters; two 200 kw, 600 volt, D. C. 3-phase, 60 cycle rotary converters; step-down transformers for rotary converters; two 100 kw, 125 volt, exciters and various A. C. and D. C. feeders.

Figure 2. Note the neat and workmanlike appearance of the rear of board resulting from use of remote mechanical control oil circuit breakers, mounted beneath switchboard gallery, and also on account of attention paid, in design and manufacture, to details and control wiring. Electrolytic lightning arresters for protection of 2300 volt feeders are also shown on switchboard gallery to rear of board.

Figure 3 shows the oil breaker structure, for 2300 volts employing asbestos lumber for barriers, cells and doors. The breakers themselves are mounted on pipe frame work.

The pleasing appearance resulting from the use of a complete and symmetrical line of meters for both A. C. and D. C. service is shown by the front view of switchboard.

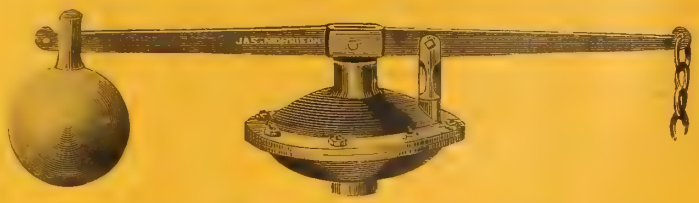
The unexcelled engineering and manufacturing facilities of the Westinghouse Company are responsible for the prompt and satisfactory manner in which this 58 panel switchboard was manufactured and erected.

Figure 2

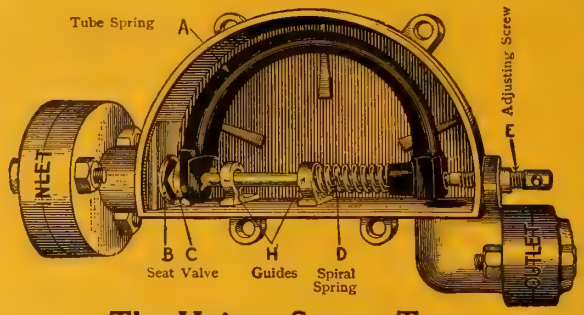
Figure 3

Canadian Westinghouse Co., Ltd., Hamilton, Ontario

TORONTO, Traders Bank Bldg. | MONTREAL, 52 Victoria Square | OTTAWA, Ahearn & Soper, Ltd. | HALIFAX, Telephone Bldg. | WINNIPEG, 158 Portage Ave. E.
CALGARY, Grain Exchange Bldg. | VANCOUVER, Bank of Ottawa Bldg.



Standard Low Pressure Damper Regulator



The Heintz Steam Trap

The Trap that stands guard over your Steam Condensation to see that you don't waste steam with the water that drains off from Heating System. Send for circular.

Feed Water and Steam Specialties

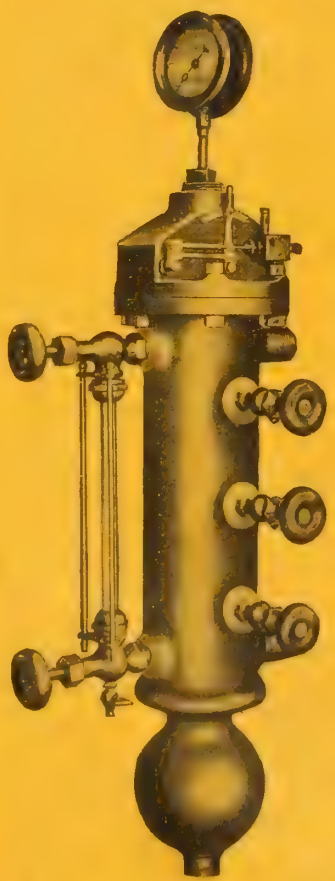
If you require serviceable Boiler Mountings — the kind that lasts as long as the Boiler we have them.

A guarantee backed by nearly 40 years' experience stands behind our goods. Write us about your requirements and we shall be pleased to send particulars and catalogue.

Our Steam Goods are approved by the Boards of Inspectors in Ontario, Alberta and Saskatchewan.

Klinger Type Water Gauge Mounting with Reflex Glass—non-breakable.

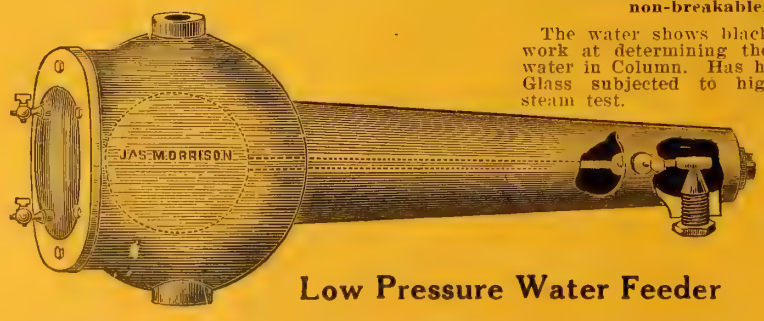
The water shows black—no guess work at determining the height of water in Column. Has heavy Reflex Glass subjected to high pressure steam test.



"Reliable" Water Column Complete

With Water Gauge Mountings, Gauge Cocks, Pressure Gauge and Whistle Alarm.

The "Accident Preventor" — the alarm is given and continues if water in Boiler gets too low, also if the supply becomes too great by failure of Water Valve to operate properly.



Low Pressure Water Feeder

Automatically regulates the water supply to Boiler, maintaining it at the required height.

The James Morrison Brass Mfg. Co. LIMITED

93-97 Adelaide St. West. TORONTO

THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas Electric, Air and Water Power; and to the operation of Refrigerating Machinery.
Published by The MacLean Publishing Co., Limited.

MONTREAL: Eastern Townships Bank Bldg. TORONTO: 143-149 University Ave. LONDON, ENG.: 88 Fleet St. E.C. WINNIPEG: 34 Royal Bank Bldg.

Vol. VI. Publication Office, Toronto—December, 1913 No. 12

PUMPING EFFICIENCY

HONEST HYDRAULIC PACKING

MANUFACTURED EXCLUSIVELY BY

PEERLESS RUBBER MANUFACTURING COMPANY

16 WARREN ST., NEW YORK.

FOR SALE EVERYWHERE

The advertiser would like to know where you saw his advertisement—tell him.

Waterous Boilers

For Power and Heating Purposes

You will find Waterous Horizontal Return Tubular Boilers in the largest industrial and municipal power plants in the country.

There are reasons for this—

They are economical of fuel—carry a big reserve steam pressure for use in emergencies,—can be used with hard and dirty water and are readily cleaned and easily taken care of. They cost little new—their up-keep and maintenance expense is negligible.

Waterous Horizontal Return Tubular Boilers are built in all sizes from 40 in. x 10 ft. to 72 in. x 18 ft. Most standard sizes are carried in stock.

If we cannot supply you at once from our yards we can turn out your order for you in quick time. On the next boiler you need, let us quote you prices and delivery.

Some Recent Installations

Canadian Pacific Railway, Calgary, Alta.	2—60″x14′
Okanagan Sawmills, Enderby, B.C.	2—66″x14′
Lake Superior Iron and Steel Co., Sault Ste. Marie	5—72″x18′
Corporation of Orangeville	1—54″x14′
Dominion Canners, Simcoe	3—72″x18′
Grand Trunk R.R., Montreal	2—72″x18′
Steel Company, Ltd., Hamilton	2—72″x18′
Dunlop Tire & Rubber Goods Co., Toronto	1—72″x18′
Imperial Oil Co., Ltd., Sarnia	5—78″x18′
M. Oldfield & Sons, Grimsby	2—66″x16′
Canadian Westinghouse, Hamilton	2—48″x14′

The Waterous Engine Works Co., Limited

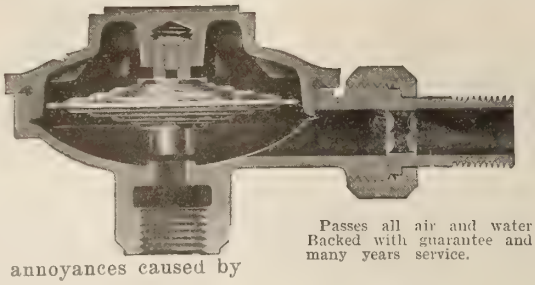
BRANTFORD, CANADA

Trial Offer:-

This means you Mr. Engineer, who is experiencing trouble from noise poor circulation or any other of the many troubles which may be experienced in your Vacuum Heating System because of faulty, clogged up or leaky Steam Traps.

If you want to relieve yourself of annoyances caused by those faulty traps

THEN we will supply you with a Dunham Radiator Trap for sixty days' Free Trial to convince you of the superiority of the Dunham. Send on your regular purchase order marked "Trial Power House." Tell us where you want to use the trap and we will send it to you. It can be returned to us at our expense if you are not entirely satisfied.



Passes all air and water Backed with guarantee and many years service.

Dunham Radiator Steam Trap

(*Made in Canada*)

For use on low pressure heating systems.
By use of these traps and a vacuum pump you can accomplish better results with 1 or 2-lb. pressure than with 50 lbs. pressure in the old way.
If you are interested we will tell you how. It means many dollars per year saving in the coal pile.

The Dunham Trap is the Original. Don't accept an imitation.

WRITE for new CATALOGS.

C. A. DUNHAM CO., Ltd., Toronto, Can.

HALIFAX	MONTREAL	FT. WILLIAM	WINNIPEG
General Contractors Supply Co., 98 Granville St.	No. 24-11 St. Sacrament St.	Plumbing & Engineering Supply Co.	215 Phoenix Bldg.

CALGARY	VANCOUVER
Metals Limited	520 Duncan Bldg.

Sales Over Five Million Dollars Annually

Four Babbitt Manufacturing Plants

TORONTO LONDON, ENG. NEW YORK ST. LOUIS

Faultless "A" This babbitt is a high grade copper hardened alloy, possessing in a higher degree all the good points of the original Genuine Babbitt, with increased antifriction qualities, having the additional merit of absorbing and holding oil. It is used extensively in France for automobile engines, and in South Africa for mining machinery, and in United States and Canada for marine engines, dynamos and all heavy duty machines. Where heavy service is required this will last longer than any Genuine Babbitt manufactured. For heavy duty, saw mills and engines it is without equal.

Eagle "A" Thousands of tons of this alloy have been placed on the market, giving such perfect results, that it's name and merits are known, we believe, as extensively as any other babbitt manufactured. Its high antifriction and heavy duty qualities make it especially adapted for saw-mills, planing-mills, threshing engines, traction engines, pumps, rolling-mills and general machine shop use.

HOYT METAL COMPANY

TORONTO OFFICE AND MFG. PLANT—EASTERN AVE. AND LEWIS ST.

The advertiser would like to know where you saw his advertisement—tell him.

JENCKES BOILERS

Horizontal Tubular

Vertical Tubular

Locomotive Types

Heating Boilers

Built to stand severe service, with the least stoppage for repairs.

Flange quality steel, conforming to Manufacturers' Standard Specifications, is used in shell and heads. The tubes are lap-welded or seamless steel of standard gauge and make; the rivets of special quality steel, and the stays are steel, without welds.

Let us send you full partiulars and connect you with users of JENCKES Boilers in your neighborhood.

The Jenckes Machine Co., Limited

Sherbrooke Montreal St. Catharines Toronto Cobalt South Porcupine Nelson Vancouver

Works: SHERBROOKE, QUE. ST. CATHARINES ONT.

The advertiser would like to know where you saw his advertisement—tell him.

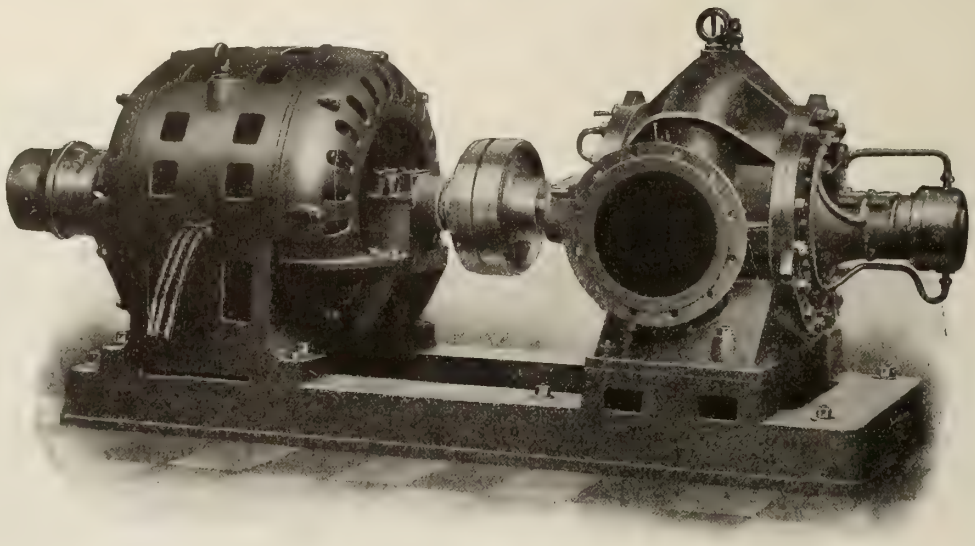
W. H. ALLEN, SON & COMPANY

LIMITED

QUEEN'S ENGINEERING WORKS, BEDFORD, England

ENGINEERS AND BUILDERS OF

Steam, Hydraulic and D.C. Electric Machinery



"CONQUEROR" PUMPING MACHINERY

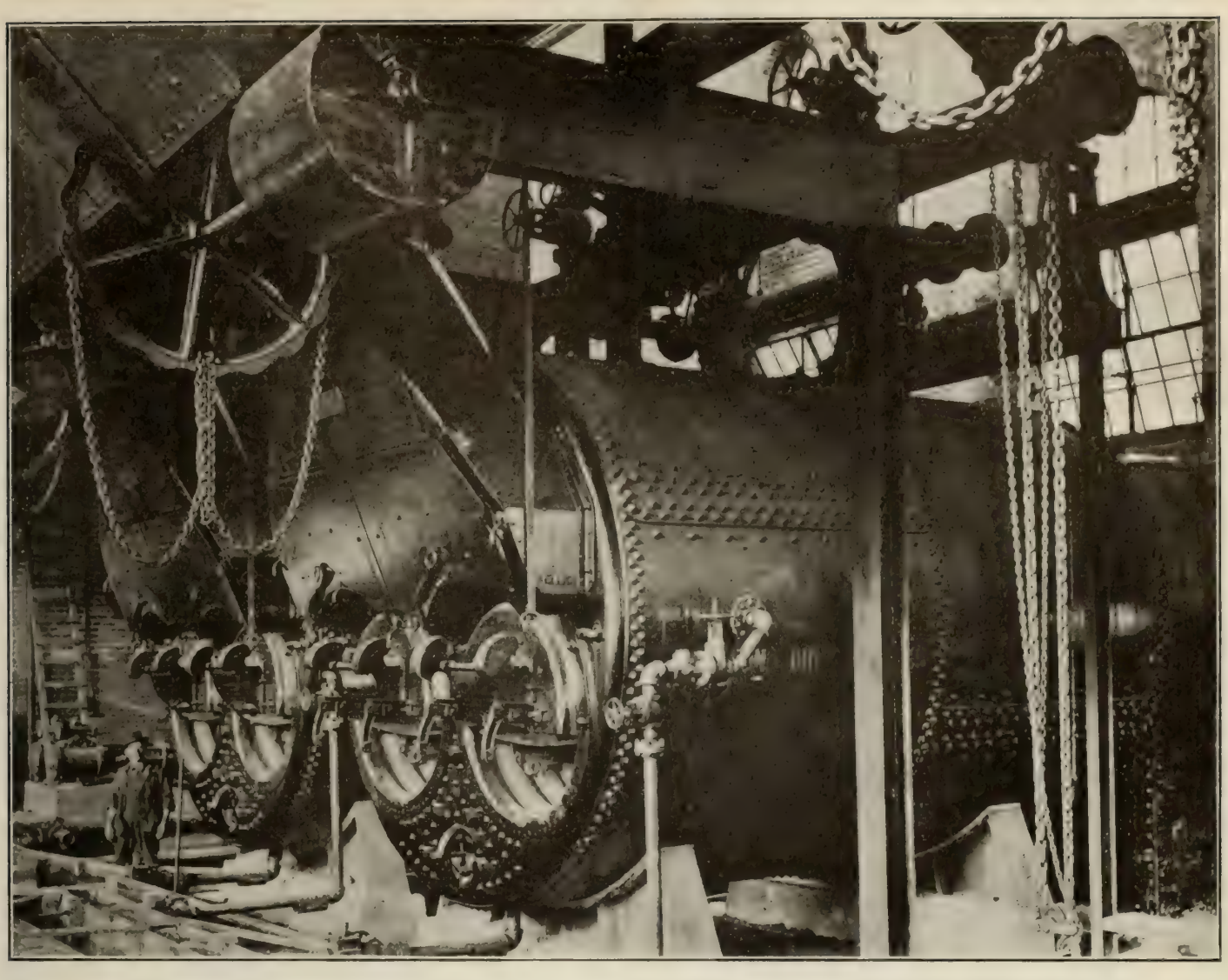
Five million Imperial gallons per day; variable pressure 50 to 128 pounds per square inch; 450 B. H. P. Motor; 1800 r. p. m. — for

CITY OF WINNIPEG

For prices and full particulars, apply to head office at

BEDFORD, England

The advertiser would like to know where you saw his advertisement—tell him.



REPEAT ORDERS TESTIFY

to the reputation that **"Polson" Boilers** have gained for correctness of design, construction and general all-round efficiency; to the number of satisfied users who are content to put their steam-raising problems up to the Polson Iron Works; to the high esteem in which they are held by engineers all over the country.

These two boilers were built to fill a repeat order from the Consumers' Gas Company, Toronto. They are of the return-tubular dry back type, each 11 ft. 6 inches diameter, and 15 ft. long. They are fitted with Morrison Furnaces and Adamson Furnaces with Galloway Tubes.

How about your boiler problems? We can give you the same service.

Polson Iron Works, Limited

Toronto, Ontario

The advertiser would like to know where you saw his advertisement—tell him.

BOWSER OIL FILTER

The Bowser Oil Filtering Outfit.

Especially Suited to the requirements of the smaller sized Plants.

Equipped with self-measuring pump, float indicator, one or two filter sections as desired, and other features exclusively Bowser.

As engineer or owner of the smaller sized power plant you wish to effect all the economy possible by proper filtration and re-use of lubricating oil. You should carefully consider this splendid outfit.

Consider **first** the **principle** of its operation, as on this the efficiency of its **service** chiefly depends. And service is what you want first, last and all the time.

After water and heavier sediments are separated by precipitation, the oil passes into the unique Bowser filter section, shown herewith. The design and materials used give this filter section unusual capacity and efficiency.

Each section has a filtering surface of 27 SQUARE FEET, the filter cloth being a special, heavy-thread, close-weave muslin. Dirty oil enters on the inside, so by removing filter section, every particle of dirt is removed from filter, making the work of cleaning very simple.

This type filter is made with one or two filtering sections as desired, having a nominal 24-hour capacity of 50 and 100 gallons respectively. This is a very conservative rating and will insure perfect filtration and long service.

Let us show you not only the equipment itself, but what Bowser Service before and after a sale means. It is worth your writing and does not obligate you to buy.

Filter Extended.

Illustration of a Bowser Filter Section extended gives you some idea of its construction and the amount of filtering surface.

S. F. BOWSER & CO., Inc.,

66-68 Frazer Avenue **TORONTO, ONT., CANADA**

Made by Canadian Workmen and Sold by Canadian Salesmen

Sales Offices in all Centres and Representatives Everywhere.

Original patentees and manufacturers of standard self-measuring hand and power driven pumps, large and small tanks, gasolene and oil storage and distributing systems, self registering pipe line measures, oil filtering and circulating systems, dry cleaner's systems, etc.

Established 1885.

A Boy's Wages, Slewes of Oil and Trouble Galore Saved by Using

MAGNOLIA METAL

WEEKS BROTHERS COMPANY, INC.
167 to 179 Richmond St.

Providence R. I.,
June 9th, 1912.

Magnolia Metal Co.,
New York.

Gentlemen:—

Magnolia Metal was first introduced to me in 1901 at the Nova Scotia Provincial Exhibition at Halifax, Canada. I was at that time Engineer with J. G. Hamilton & Sons, Confectioners, Pictou and Halifax. We had a Sugar Pulverizer which ran 2,500 R. P. M. and we could not keep it cool. Had a boy stand all day with an oil can to keep it running. The journals were 16 inches in length, shaft 2 inches in diameter, bottom half cast in frame of machine. The night watchman and I after melting the old metal out with a plumber's torch and getting the shaft lined up, completed the job in about two hours. After that I speeded the machine up to 3,000 R. P. M., and we would fill the grease cups on Monday morning and it would run 10 hours a day for a week without any care or attention.

I cannot say too much for Magnolia. It is easy to pour and almost any novice can make a decent job. I wanted some hangers of a peculiar shape one time, and I got a piece of iron bar 4 inches by ¼ inch and made them into the shape required with loops for the bearings and babbitted them with Magnolia. Both these jobs ran every working day and were in good order without any trouble at the end of four years.

I always specify Magnolia Metal for all my work.

Yours truly,

JOHN S. BELL, Ch. Eng.

SOLD BY LEADING DEALERS EVERYWHERE OR BY

MAGNOLIA METAL CO.

OFFICE AND FACTORY:

225 St. Ambroise St., - - MONTREAL

POTATO SCALE BOILER CLEANSER

If you could burn coal in water, you might be able to construct a boiler in which scale would not bother you.

But you can't; you've got to separate them; hence the boiler as you know it to-day.

You wouldn't think of coating the fire-box and tubes of your boiler with asbestos compound; you'd know what would happen.

Well scale is every bit as bad; it forms quietly, insidiously. Like a valve, it gradually shuts off the heat from where it should go—the water.

Chipping it off is a poor remedy—you must get to the root of the matter—the boiler feed.

Potato Scale Boiler Cleanser can be suited to correct the impurities in any feed water. Fed into your boiler, it will quickly free tubes and sheets of all adhering scale. Used regularly it will keep your boiler clean as a "new pin." Its acid correcting properties prevent pitting and honeycombing.

Send us a gallon of your feed water, we'll analyze it and prescribe the right "Potato Scale Treatment" free. Remember every day you put it off that "heat valve's" closing tighter and tighter, sending precious dollars up the chimney, that should go into the water.

You'd better go and get that gallon---now

C. C. SNOWDON

Branches:
Edmonton
Winnipeg
Vancouver

1810-1840 11th STREET EAST, CALGARY, ALBERTA
P. O. Box 1384

Refiner, Importer and Manufacturer of

Pennsylvania Lubricating and Refined Oils, Gasoline, Potato Scale Powder, Liquid Soap, Disinfectants, Polish, Waste, Oil Tanks, etc.

Stop Blow-outs and Leaks in Pipe Lines by Using

GOETZE No. 2 ELASTIC GASKETS

If you start right now to renew with No. 2 ELASTIC GASKETS, you can steadily reduce your renewals until you have brought them almost to the vanishing point.

This is not a mere "claim"—it is backed up by a *guarantee*—in fact the strongest guarantee ever made by a gasket manufacturer.

Think what it means to re-gasket a joint so it will *keep tight for years,* instead of days or weeks. Think of the saving resulting in gasket costs, labor and shut-downs.

What No. 2 Elastic Gaskets Will Do

No. 2 ELASTIC GASKETS will make the most troublesome joint you have absolutely tight — and keep it so. They "stay put" and stay tight. Prevent leaks, blow outs and shut-downs. Will practically eliminate renewal expense for gaskets.

No. 2 ELASTIC GASKETS are for high pressure and super-heated steam lines, but owing to their indestructible nature, are equally adapted to *any and every condition* about a factory, mill or refinery.

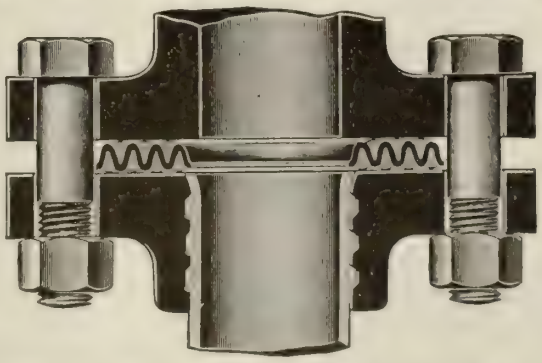
The No. 2 Elastic Guaranteed

Every No 2 Elastic Gasket is Guaranteed for 5 Years Continual Service in the Same Joint

There are no "ifs and ands" about this guarantee. It means just what it says. It applies to every No. 2 GASKET whether bought direct from us or through a dealer.

How No. 2 Elastic Gaskets are Made

These Gaskets are made of corrugated copper with asbestos lining No. 2. The corrugations allow for expansion and contraction of the pipes, while the asbestos, being forced into the



pores of the metals in the flanged surface by the "squeeze" and the constant pressure of the corrugations beneath it, holds securely against the highest pressures.

Goetze Gaskets are carried in stock by

T. McAVITY & SONS, LIMITED

ST. JOHN, N.B.

BRANCHES AT

MONTREAL, 112 St. Peter St. — TORONTO, Mills Bros., 809 Lumsden Bldg. — WINNIPEG, C. E. Chown, 425 Henry Ave. — LETHBRIDGE, Alta., J. B. Turney & Co. — VANCOUVER, c/o A. O. Campbell, 626 Pender St.

MANUFACTURED BY

Goetze Gasket & Packing Co., New Brunswick, N.J.

The advertiser would like to know where you saw his advertisement—tell him.

Does the Giant Friction Grip Your Rods?

If you wear rubber overshoes when walking on a slippery surface to create the necessary friction to keep from falling,—

then why do you place layers of rubber and cotton duck against the smooth surface of your rods when friction is just what you don't want?

Rubber Contains No Lubricant,—
In Fact, Oils and Lubricants Destroy Rubber

To get away from friction you ought to use

PALMETTO" PACKING

REG. TRADE MARK

It contains no rubber or other friction-producing materials. Each tiny strand of "Palmetto" is a reservoir of its own lubricant, which it gives out automatically to the rod, keeping it in a practically frictionless state.

"Palmetto" Keeps the Rods as Smooth as Velvet

and so prolongs its life, even under severe conditions, that it gives the longest service of any packing manufactured.

Try a Free Working Sample.

Braided round and square for rods. Twist for globe valves, injectors, etc.

GREENE, TWEED & CO.
Sole Manufacturers
109 Duane Street New York

Canadian Distributing Agents, The Canadian Fairbanks-Morse Co., Ltd., Montreal, Ottawa, St. John, Toronto, Winnipeg, Calgary, Saskatoon, Victoria, Vancouver.

The advertiser would like to know where you saw his advertisement—tell him.

Those Kiddies of Yours

How fast they are growing, and with them the expense for clothes, etc. Likely you will want to send one or more of them to a business school—possibly to college. That will mean the necessity for larger earning on your part; a better position in a bigger plant.

Let us assist you prepare for a job higher up. Our Valve Book will prove a big help for it tells in plain language and many illustrations, things you need to know about the various types of slide valves. It is priced at $1.00, but we will send you a copy absolutely free, if you fill out and mail the coupon.

DANIEL'S ROD PACKING P. P. P. COIL RING SPIRAL

Economy in cost of operation of a steam plant is one of the biggest factors in bringing the engineer to the attention of the "old man" and of securing a substantial raise in pay.

We have another book—"The Story of Some Friction Tests" which will tell you how you can prove to the "boss," by means of your indicator, that you can save him a good round sum of money every year. Actual tests by leading mechanical engineers showed savings of $104.96 to $250.00 a year, per rod. In one instance, on a type of engine in general use, the reduction of operating expense was $590.00 annually.

These economies were effected by the use of Daniel's P. P. P. Rod Packing—the famous "give-and-take" packing that automatically regulates the bearing on the rod to the requirement; increasing as the steam pressure increases, and decreasing as it loses its pressure through expansion.

When the steam is acting from the head end there is practically no bearing on the rod, except during the very short period of compression—a clear saving of nearly 50% of the unnecessary friction caused by solid packings and others constructed on the wrong principle.

During the forward stroke, the bearing of P. P. P. on the rod is never in excess of the bare requirement to hold steamtight, and you, as an engineer, know that this means a variation of from maximum pressure to but a few pounds, where other packing maintain a constant maximum pressure with the consequent loss of power to overcome it.

We will send you a free copy of the Friction Book along with the "Slide Valve." Mail the coupon NOW.

How to Get the "Slide Valve" FREE

Fill out the Coupon, and mail it to us. We will address a book to you, and send it FREE of charge.

Your Name .....

Address .....

Employed by .....

Address .....

Horsepower of Engine .....

Kind of Rod Packing Used .....

Do You Use EBONITE Sheet Packing? .....

Dealer's Name .....

Address .....

Name of Buyer .....

..... Series 24-

DANIEL'S P. P. P. ROD PACKING

is imitated more than any other packing made. But the imitation is in appearance and claims only. None but the genuine gives the results

QUAKER CITY RUBBER COMPANY

Manufacturer of Mechanical Rubber Goods

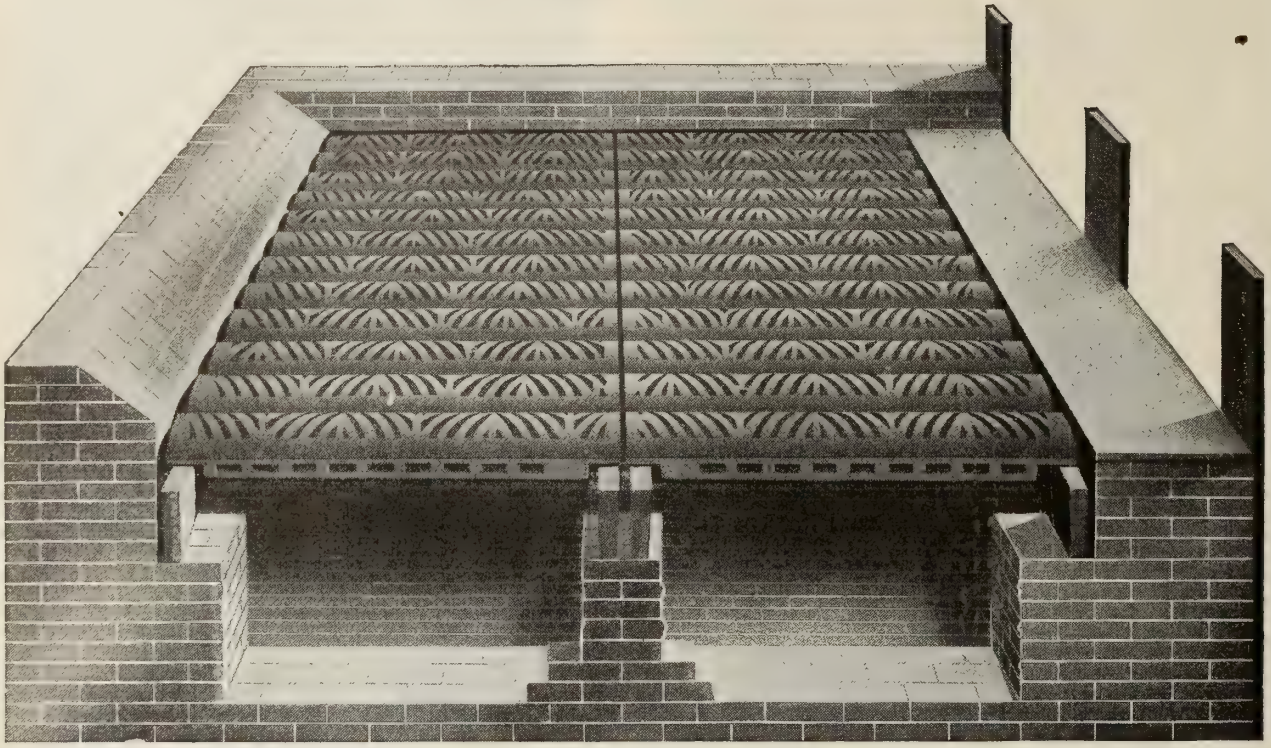
PHILADELPHIA	CHICAGO	PITTSBURGH	NEW YORK
629 Market St.	182 W. Lake St.	207 Wood St.	207 Fulton St.

The advertiser would like to know where you saw his advertisement—tell him.

THOMAS ELLIPTIC GRATE BARS

SHAKING—CIRCLE—STATIONARY

FOR EVERY FUEL



THOMAS IDEAS

PATENTED

THOMAS ELLIPTIC GRATE BARS	INCREASE STEAM—SAVE FUEL—SAVE LABOR —COST LESS—REDUCE SMOKE.
THOMAS GRATE RESTS	EVERLASTING—PRESERVE GRATE BARS—PROTECT FIRE WALLS.
THOMAS FURNACE SETTING	FIRE WALLS—BRIDGE WALL—FRONT WALL independent of all expanding and contracting irons. SEE THAT AIR SPACE COMPLETELY ENCIRCLING THE GRATE AREA. No dead and burned grate bar ends. No pushed down walls from expansion of grates.

Shipped from Hamilton, Ont. **Let us give you complete information.**

FOR ALL PROBLEMS

Steam—Grate Bar—Furnace—write THOMAS

The General Supply Co. of Canada, Ltd.

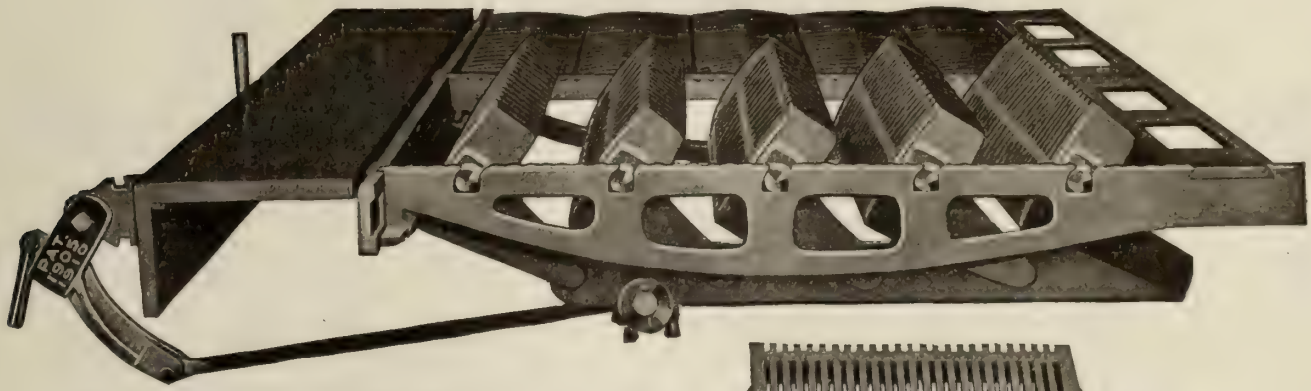
OTTAWA TORONTO WINNIPEG

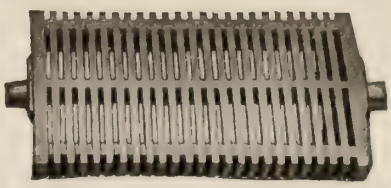
THOMAS GRATE BAR CO., **Birmingham, Ala., U.S.A.**

"THE Cyclone"

Shaking and Dumping Grate Bar

For that old Boiler!





There is only one **"Genuine."** The imitations flatter us, but won't give you service like the **"Cyclone."**

The old boiler has always been wasteful; always took a lot of firing to keep steam up.

You've got to renew those old bars anyway. Put in a **"Cyclone"**—it will give her a new lease of life.

The **"Cyclone"** Shaking and Dumping Grate makes burning **any** fuel an easy proposition.

The positive locking device keeps all the Bars in place, yet is easily released when you want it. The improved shaking mechanism gives such vigorous movement, there's no chance for clinkers to stick to the bars.

Let us put you in touch with some satisfied users—they'll tell you.

The Canadian Steam Boiler Equipment Co., Limited

SOLE MANUFACTURERS FOR CANADA

211 QUEEN STREET EAST :-: :-: :-: **TORONTO, CANADA**

AGENTS

ST. JOHN, N.B., F. W. Blizard, Canada Permanent Chambers. MONTREAL, H. L. Peiler & Co., 308 St. James Street.
HAMILTON, Robt. Fitzsimmons, 8 Grove Street. CALGARY, Alta., The Western Foundry & Metal Co., Limited.
BERLIN, J. Hainsworth, 14 Foundry Street. WINNIPEG, Vulcan Iron Works.

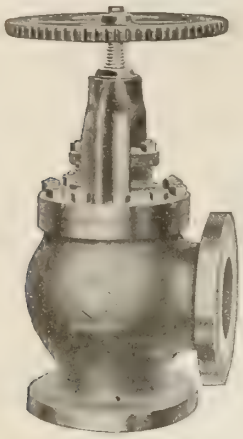
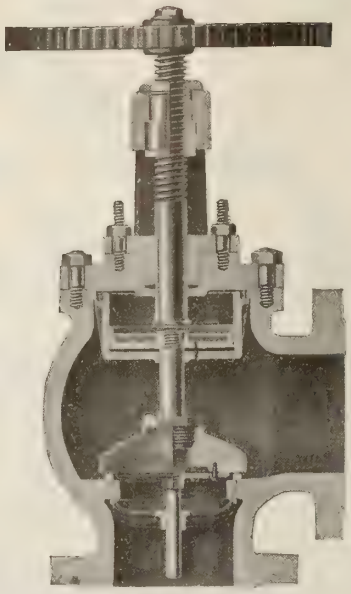


Fig. 293
Angle, Screwed.
Fig. 292
Angle, Flanged.
Fig. 293



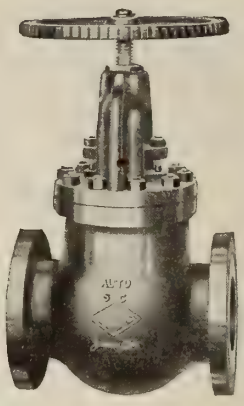


Fig. 291
Globe, Screwed,
Fig. 290
Globe, Flanged,
Fig. 291

No Boiler Room is Complete
Without This Double-Purpose Valve

No boiler room is safe without it. And no engineer can be content without it when he knows that it will **automatically** equalize the pressure in every boiler in a battery, besides acting as an automatic stop in case of a bursting boiler tube or other external rupture.

Jenkins Bros.' Automatic
Equalizing Stop and Check Valve

For instance, suppose your boilers are **not** equipped with these valves—a tube bursts —the entire boiler room is filled with scalding steam—your hand operated boiler cut-off must be closed—by you—possibly at the risk of your life.

Then—afterwards, you get one of these Jenkins Bros'. Automatic Equalizing Stop and Check Valves for every boiler in your plant.

But why wait for the trouble to warn you?

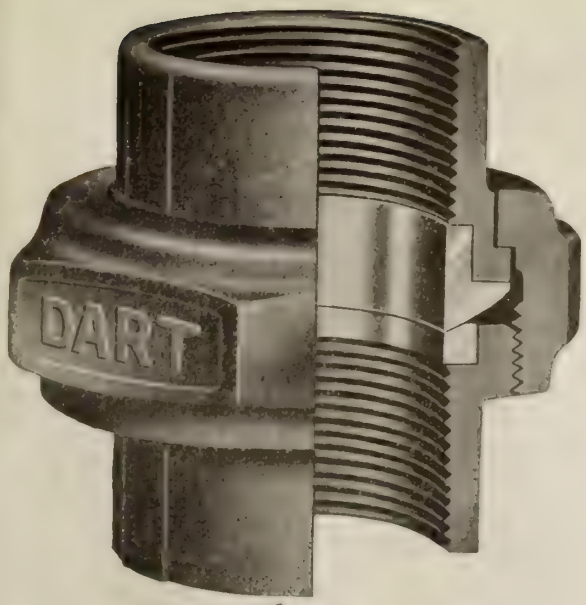
Anyway, the **pressure equalizing** feature is argument enough.

Make your start, Mr. Engineer, **now** for better economy—for surer protection—by examining this valve at your dealer's or writing us for further particulars.

Copy of our latest catalogue mailed free on request.

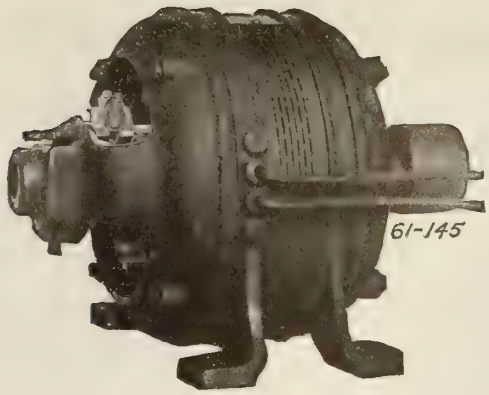
JENKINS BROS., Limited

103 St. Remi Street **MONTREAL**



Good Health
Good Luck
and
Merry Holidays
to You

DART UNION CO., Limited
TORONTO



An Ordinary Knife Switch Entirely Controls—

the Wagner Type B.W. Polyphase Induction Motor—*one three-pole single-throw switch.*

Its simplicity of operation assures absolute safety. It is particularly suitable for installation in places difficult of access.

This Wagner BW MOTOR

is a polyphase type motor that embodies the mechanical features that have produced the desirable starting and operating performances of the Wagner single-phase motor.

—high torque with low current at starting.

—the ideal operating features of squirrel cage construction.

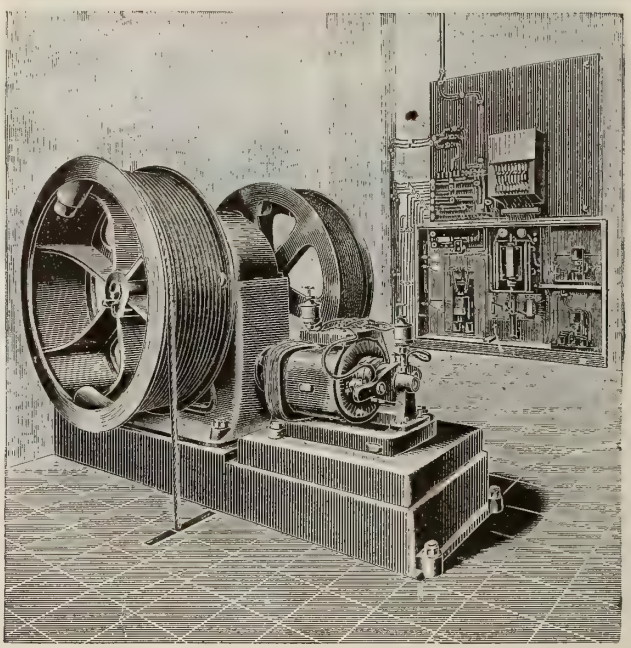
Write our nearest house for full descriptive information.

THE Northern Electric AND MANUFACTURING CO. LIMITED

MONTREAL	WINNIPEG	EDMONTON
HALIFAX	REGINA	VANCOUVER
TORONTO	CALGARY	VICTORIA

Elevator Equipment

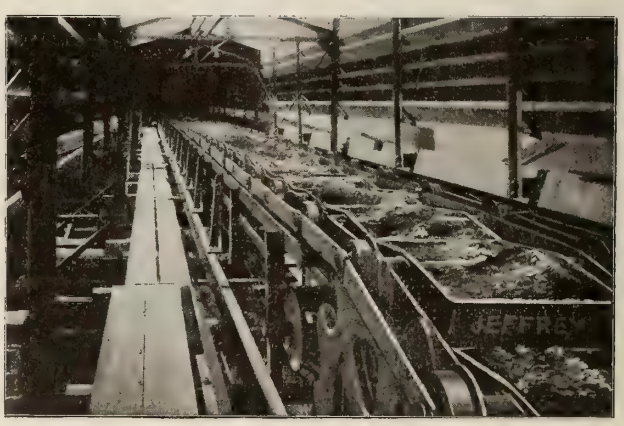
Traction Type



Stigler's Patented Passenger and Freight **Elevators**

Engineering Works of Canada

Head Office: 805-7 New Birks Bldg., : : Montreal, Quebec



Jersey Pivoted Bucket Conveyer handling 50 tons coal per hour.

Savings Commence the very day that JEFFREY Coal and Ashes Handling Systems are installed.

They are the last word in cost-cutting power-plant operating.

Catalog No. 32-A gets you details of CORRECT Coal and Ashes Handling Equipment. Send for it.

JEFFREY MANUFACTURING COMPANY

Canadian Main Office and Works, MONTREAL

Winnipeg Representatives, N. J. DINNEN & CO.

The advertiser would like to know where you saw his advertisement—tell him.

GARLOCK GREETINGS

We wish our friends

A Merry, Merry Christmas

and

A Happy New Year

is assured everyone who has wisely selected reliable packings

May your troubles during the year be few—as your packing troubles will be if you use

"GARLOCK"

This is our Toast to you for 1914

The Garlock Packing Company

HAMILTON, ONTARIO

MONTREAL TORONTO WINNIPEG CALGARY

"Pioneers in The Packing Business"

SUNBEAM
MAZDA LAMPS

Give Daylight Efficiency to All Twilight or Midnight Operations

Now is the time of the year when your employees work longest by artificial light. Don't blame them if work done after or before daylight is not up to the mark.

From your plant's interest you should co-operate with your employees by improving your lighting system — use Sunbeam Mazda Lamps.

Sunbeam Mazdas burn in any position, and in every socket where they are used give **three times as much light as the carbon lamp at the same cost.**

The clear white light that the Sunbeam Mazda Lamp produces makes possible the production of the same quality and quantity of work that is done by daylight.

Do you think you can afford to keep on using the carbon lamp? **Our large stock of Sunbeam Mazda Lamps enable us to make prompt shipments.**

Satisfaction guaranteed.

The Canadian Sunbeam Lamp Co., Limited

Main Office and Factory: TORONTO

Branch Warehouses:

MONTREAL, WINNIPEG, CALGARY, VANCOUVER

Electrical supplies of all kinds

If you are in need of any kind of electrical supplies, such as switches, plug cutouts, etc., remember we make a speciality of these. Be sure you get those that are stamped with

DUNCAN TRADE MARK

This Trade Mark

IT IS A GUARANTEE OF

DUNCAN QUALITY.

Order through your Jobber, or direct from

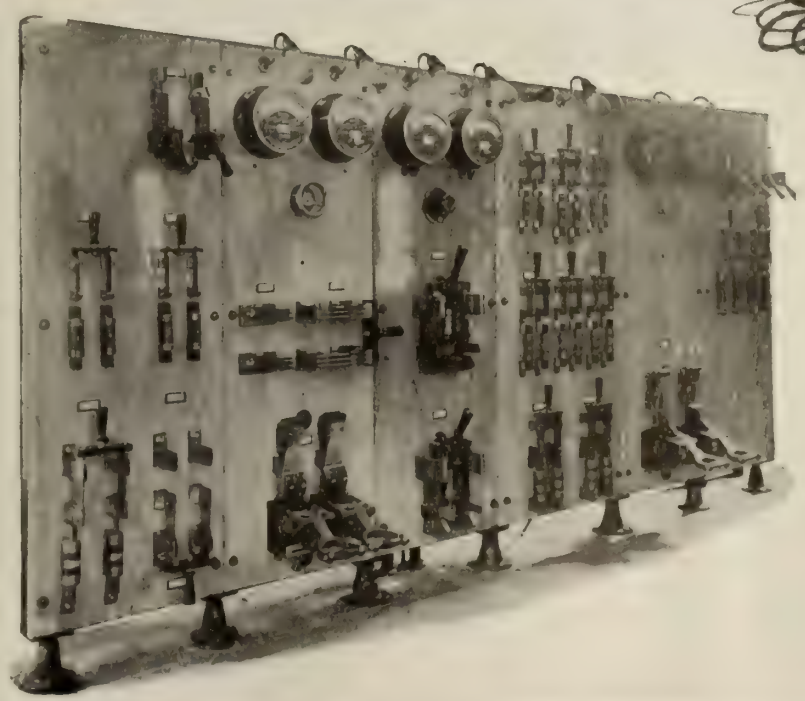
The Duncan Electrical Company

Limited

Montreal

MONARCH ELECTRIC CO., Limited

ST. LAMBERT, P. Q., District of Montreal

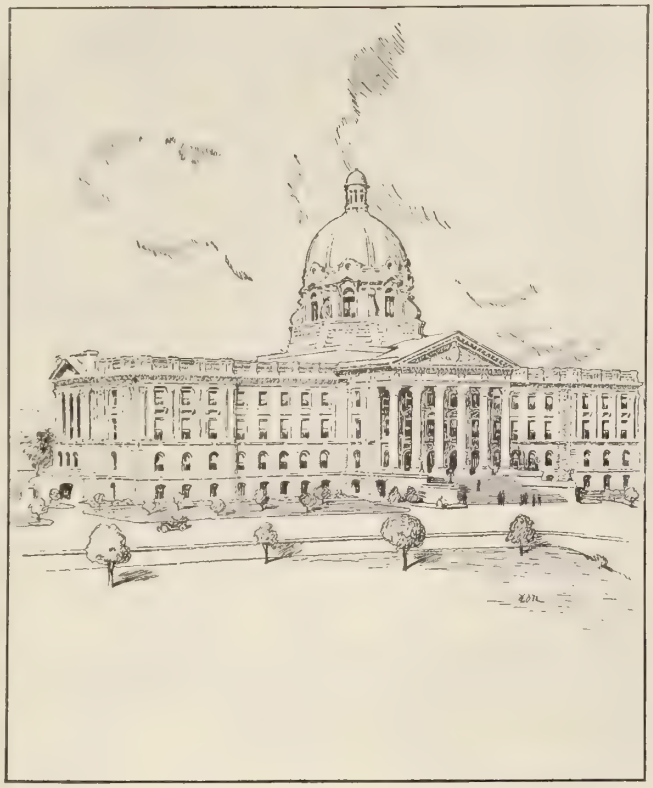


Switch

Board

Specialists

The advertiser would like to know where you saw his advertisement—tell him.



Across Canada

with the

IMPERIAL WIRE and CABLE COMPANY, LIMITED

Toronto MONTREAL Winnipeg

Sixth of a series of advertisements showing buildings of national importance which have been wired with the Imperial Wire & Cable Co.'s, Limited, wires.

This picture shows the

PARLIAMENT BUILDINGS, EDMONTON.

This building was wired with "Adanac" Rubber Insulated Wire.

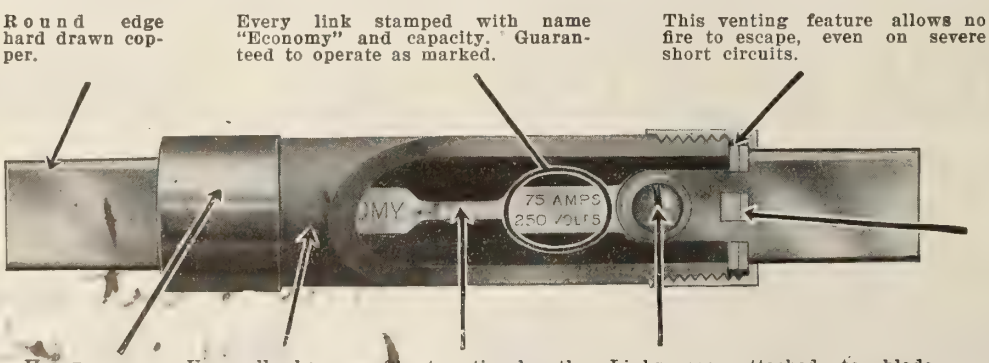
Architect, A. M. Jeffers, Edmonton.
Engineer, James McAlear, Chicago.
Electrical Contractors, Cunningham Electric Co., Calgary.

Address enquiries to nearest office

MONTREAL TORONTO WINNIPEG

Enquiries from Alberta and British Columbia may be addressed to Northern Electric & Manufacturing Co., Limited, Calgary and Vancouver.

"ADANAC," "IMPERIAL HIGRADE" and "30% PARA."


Round edge hard drawn copper.
Every link stamped with name "Economy" and capacity. Guaranteed to operate as marked.
This venting feature allows no fire to escape, even on severe short circuits.
75 AMPS
250 VOLTS
Washer assembly centres, locks in position and aligns blades.
Heavy solid brass cap.
Unusually heavy gray horn fiber shell.
Short, active length of element assures uniform performance.
Links are attached to blade member by heavy machine screws.

Light and Power Companies, Large Corporations, Industrial Plants, Mining and Smelting Companies, Department Stores, Hotels, Office Buildings, Electric and Steam Railroads, Steamships, U. S. Government, and many other classes of users are **reducing fuse Maintenance expense** over 80 per cent. by using

ECONOMY RENEWABLE FUSES

They use Economy Renewable Fuses for these reasons:

First, of course, because it provides a practical method of reducing the fuse maintenance expense more than 80%.
Second, because it is the only renewable fuse that is uniformly rated.
Third, because it is the only design so far produced that provides the desired electrical characteristics.
Fourth, because all capacities of renewal elements are readily available, making large fuse stocks unnecessary.
Fifth, because they never vent fire or hold a sustained arc and are absolutely safe.
Sixth, because they meet the performance specifications governing the use of such devices.

Special Announcement!

Two Economy Renewal Elements are now furnished (without charge) with each Economy Fuse. Now YOU figure what fuse is the cheapest not only to buy but also to maintain.

Write for Bulletin, Prices and Discounts

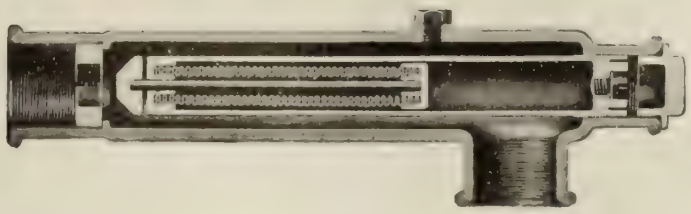
Economy Fuse & Mfg. Co. of Canada, Limited

Herald Building, Montreal

ECONOMY Renewable Fuses are sanctioned by the Canadian Fire Underwriters' Association.

The advertiser would like to know where you saw his advertisement—tell him.

NOTICE



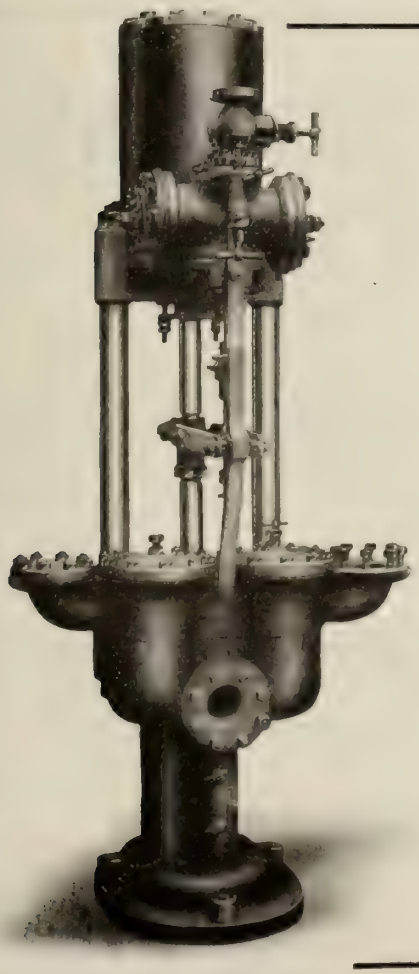
The Genuine "Sarco" Thermostatic Steam Trap (Samson's Patent No. 133942), is sold exclusively by the sole concessionaires for North America, THE SARCO ENGINEERING CO., New York, and their agents in Canada, PEACOCK BROTHERS, Montreal and Vancouver.

Upwards of 500,000 now in use. Sizes up to 3 in. in stock.

Send for price list and leaflet No. 5

PEACOCK BROTHERS

MONTREAL **VANCOUVER**



"WEIR"

THE UNSURPASSABLE PUMP

THE GREATEST EFFICIENCY. THE GREATEST ECONOMY.

Over 50,000 now in use.

The Largest Vessel in the World,
The Largest Battleship in the World,
The Most Powerful Battle Cruiser,
The Fastest Torpedo Boat Destroyer,
The Most Luxurious Yacht Afloat,
The Greatest Dredger,
Are all fitted with WEIR AUXILIARIES.

The largest and most up-to-date plants in Canada are all equipped with

Weir Feed Pumps

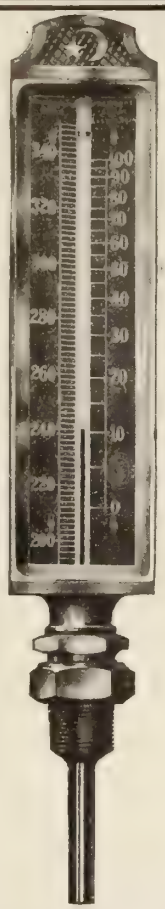
List of Canadian users sent upon application.

Send for catalogue No. 4.

SOLE AGENTS

PEACOCK BROTHERS

Montreal **Vancouver**



"Crescent" Thermometers

THE accumulated knowledge and experience of over 60 years of Thermometer making is embodied in every "Crescent" Thermometer.

This is your assurance of the very highest degree of mechanical perfection in Thermometers. Best Quality of material and extreme accuracy are a matter of course.

A copy of our instructive Thermometer Catalogue is yours any time you ask for it. Why not send a postal for it to-day? Ask for Catalog W 200.

The Schaeffer & Budenberg Mfg. Co.

Makers of Steam and Mechanical Engineering Instruments of Every Description

BROOKLYN, N. Y.

131

NEWTYPE BERGMANN LAMPS

(Tungsten Filament)

THE UNBREAKABLE KIND

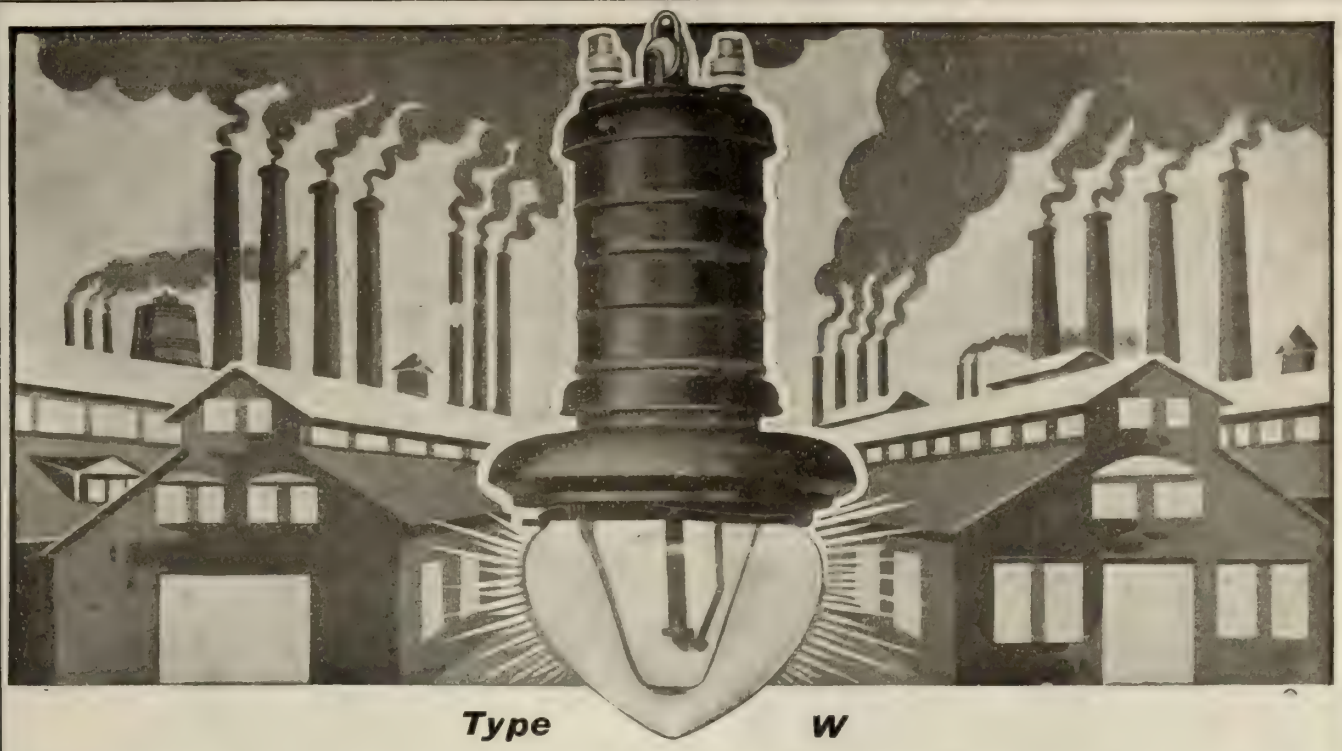
Are now ready for delivery. We guarantee delivery to you in good condition.

EXCLUSIVE CANADIAN DISTRIBUTOR:

P. H. KLEIN CO., Limited

Live Agents wanted all over Canada. **23-25 Dowd Street** **MONTREAL**

The advertiser would like to know where you saw his advertisement—tell him.



Type W

LONG LIFE FLAME ARC LAMP

In power houses, factories, yards, warehouses, foundries, machine shops, in fact wherever good, brilliant illumination is required over large areas this type of lamp is ideal.

C-G-E Flame Arc Lamps (Type W) are designed particularly for that purpose. **The Brilliancy** of the widely diffused illumination from this lamp remains constant throughout its long electrode life.

The arc is steady and is always in the same focus from start to end of trim.

Lower carbons have a life of from 100-125 hours, while the upper electrode is practically non-consuming.

Trimming is very simple and only one carbon is renewed. Either a white or yellow light can be obtained as desired, depending on carbon.

The mechanism is simple and readily accessible. One noteworthy feature is the efficient clutch which is sensitive and positive in its action.

The casing is weatherproof and insect-tight. This C-G-E Long Life Flame Arc Lamp is strongly and substantially built throughout. It is as reliable in operation as it is sturdy in construction.

Our branch office in your district will gladly furnish further information on request.

CANADIAN GENERAL ELECTRIC CO.

Limited

HEAD OFFICE - - - TORONTO

District Sales Offices:

Montreal, Halifax, Ottawa, Fort William, Winnipeg, Calgary, Vancouver, Victoria, Cobalt, Regina, Edmonton, Porcupine, Saskatoon, Nelson, Prince Rupert

Your Belting Upkeep

Cost day by day may seem small, but add 365 of these small amounts together and the yearly cost will surprise you.

There is a positive way of reducing this expense, and that is by using

D. K. McLAREN'S

Genuine British Oak Tanned

LEATHER BELTING

It has a minimum of stretch, and wonderful lasting qualities.

No wonder, it is under the supervision of experts from selection of hides until it is stamped with our trade-mark guarantee and shipped.

It is tanned by the slow, old-fashioned British Oak Method which gives leather exceptional strength and durability.

It is thoroughly stretched before being made up, eliminating much of the expense in tightening that prevails where ordinary belts are used.

We want to get you in touch with users. May we have the opportunity now?

Genuine Oak

A Guarantee that is on every piece of D. K. McLaren High Grade Belting.

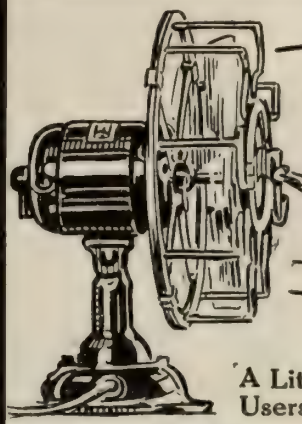
D. K. McLAREN Limited

Montreal
351 St. James St.

Toronto
200 King St. W.

Vancouver
37 Alexander St.

St. John, N.B.
64 Prince William St.



Do Your Pulleys Fan the Air?

A Little Lesson for Belt Pulley Users—Concerning Air Resistance

If the blades of an electric fan were straightened so as to cut the air, the fan could be run at its regular speed at much less cost. The same principle applies to your belt pulleys. Imagine the air resistance of fifty, one hundred, or more pulleys not constructed with special attention to air resistance. Calculate the unnecessary power cost. Eliminate needless expenditure by the installation of

"American" Steel Split Pulleys

The "American" Pulley "A"—braced arms (edge-on) give least air resistance and, at the same time, perfect rigidity, trueness and strength. "Americans" cut the air. This is but one of the "American" power-saving features.

Write for "Factors of Energy"—a useful little book.

Patented

THE AMERICAN PULLEY COMPANY

OFFICE AND WORKS: PHILADELPHIA, PA.

Large stocks of "American" Steel Split Pulleys are carried at the following warehouses, insuring prompt shipment to customers.

CANADIAN DEALERS:—Williams & Wilson, Limited, Montreal, Quebec; A. R. Williams Machinery Co., Limited, Toronto, Ont.; St. John, N.B.; Winnipeg, Man.; Calgary, Alberta; Vancouver, B.C.

"Maple Leaf" Brand

Stitched Cotton Duck Belting

THE BEST FOR ALL KINDS OF BELTS

Means Reduced Upkeep Expense and Efficient Service

"MAPLE LEAF" is the strongest, truest running, and most economical belt on the market for Transmission of Power, Conveying, etc.

Ask us for further information and prices.

Dominion Belting Co., Ltd.,

HAMILTON, CANADA

Use Stephenson Bar Belt Dressing

Make 1914 a record breaking year. Turn over a new leaf and get rid of the things that have been causing needless trouble and expense. Adopt the things which will make your work easier, give better results and save money for your employer. You cannot start at abetter place than with your belt dressing.

Get rid of your troublesome liquid dressing. Shake the can for the Stephenson solid stick and shake trouble at the same time.

Stephenson Bar Belt Dressing is a friend in need. It doesn't require preparation, nor do you have to use special care in applying it. The minute the belt slips you hold the Stephenson bar to the belt for a few seconds and the slipping stops. There's no waste—no slop—no smearing on of paste or pouring on of spattering liquid. And the results are better.

I'll "Stick to the Solid Stick"

Start With a Free ½ Lb. Sample

Simply send us your name and address and we ll send you a present in the shape of a free half-pound sample of Stephenson Bar Belt Dressing.

Remember—we give you this sample absolutely free of charge. Get this free half-pound of the finest belt dressing made and test it. Here's your chance to try somesomething really good at no expense.

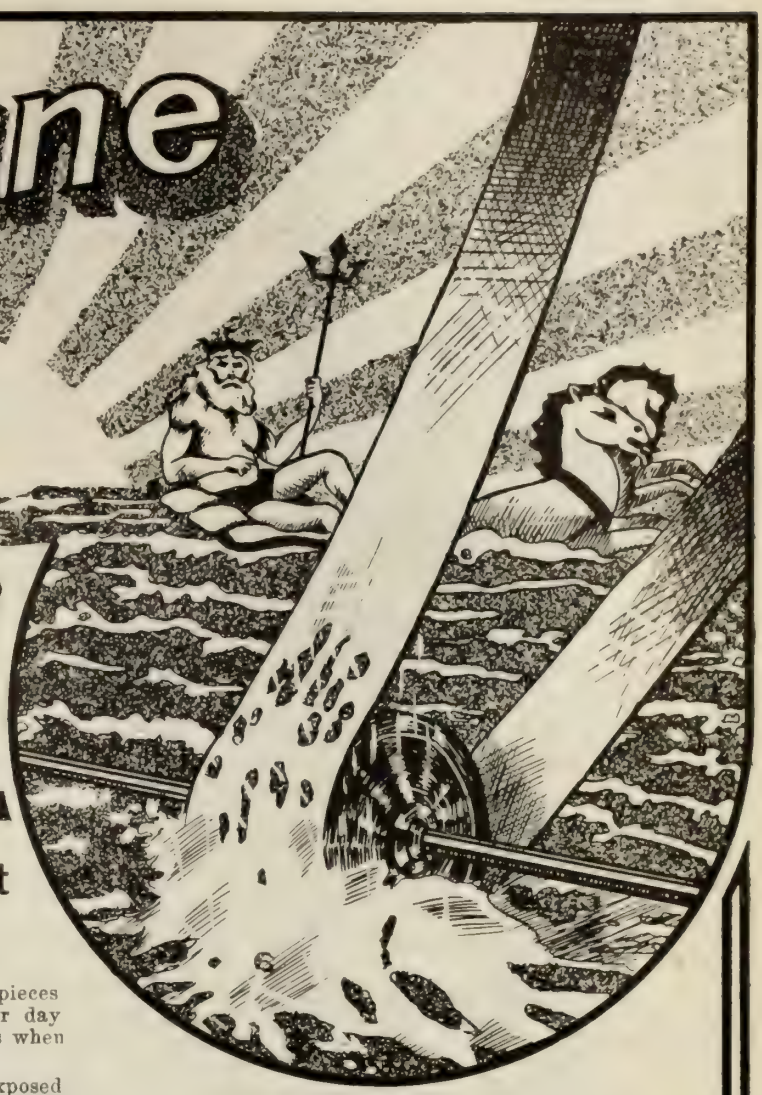
None Genuine Without Trade-Mark

Stephenson Manufacturing Company

Est. 1888 Albany, N.Y. Inc. 1897

The advertiser would like to know where you saw his advertisement—tell him.

Neptune



Waterproof LEATHER BELTING

Will Revolutionize Your Cost Of Power Transmission

In places where the ordinary belt goes all to pieces "**Neptune**" **Belting** runs right along day after day every joint and every lap as tight and secure as when first put on.

"**Neptune**" **Belting** has been run out of doors exposed to rain, snow, and sun—it has been wholly submerged in water for hours at a time—frozen solid in ice—and exposed to scores of adverse conditions—it has stood the test every time—the laps will not loosen nor if double belting is used will the belting come apart between the plies.

Neptune is sold under a positive guarantee which protects you absolutely—a guarantee of perfect satisfaction. Why not try out a **Neptune** in your plant, and let it prove its special characteristics, and assist you in solving your belting problems?

Send for a copy of our Neptune Book—its 24 pages are of vital interest to every belting user. Write to-day.

This FREE 40 PAGE BOOK, "Care of Belting," will tell you how to get the most service from your belts—tells how to repair laps of leather belting—tells how to cover iron pulleys with leather and many other things that will be of interest to every belt user.

The Graton & Knight Mfg. Co.

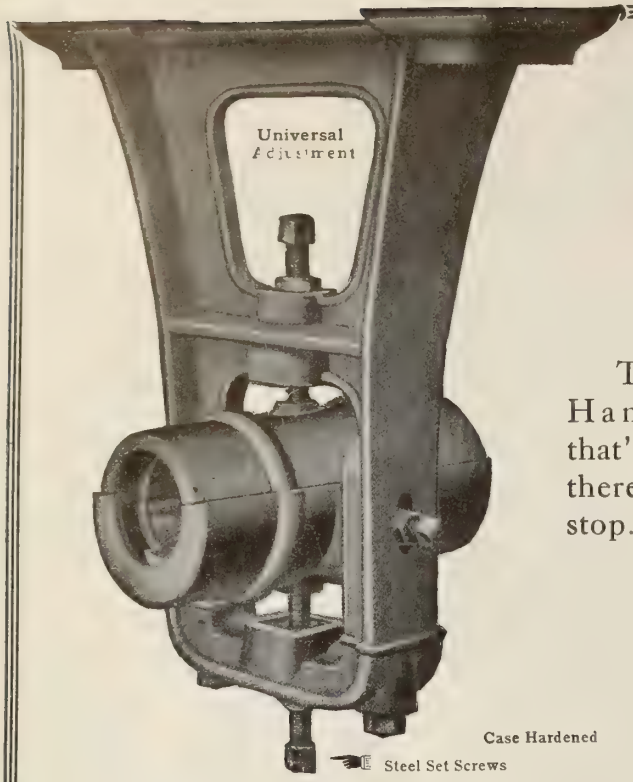
Worcester, Mass., U.S.A.

Kansas City, Mo.,	Atlanta,	New York,
Philadelphia,	Chicago,	St. Louis,
Pittsburgh,	Detroit,	Seattle,
Cleveland,	Milwaukee,	Minneapolis,
Portland, Ore.,	Boston,	San Francisco.

Canadian Branch

Unity Building, 468 Alexander St., Montreal, P.Q.

The advertiser would like to know where you saw his advertisement—tell him.



Let the

Bond Maximum Service Hanger

solve your transmission problems. They have been proven actually the best by test.

The Hanger that's up there to stop.

The "Bond" Patent Spiro Compression Coupling

50% more gripping force than any other Compression Coupling.

Get our Catalog 25—You'll find in it all transmission specialties.

Canadian Bond Hanger & Coupling Co., Ltd.

ALEXANDRIA, ONT.

THE TRIPLEX BLOCK

The Best Practice in Power Plants

THE new book of Hoists shows modern boiler room installation for handling coal by electric hoist and trolley. Under 4,000 lb. loads these hoists travel 350 feet per minute from bunkers to furnace, controlled from the floor or from a trailer cage.

Both for the Power Plant or Marine Engineer this book shows the latest application of chain blocks and trolleys to enable one man to lift, move and adjust any load up to 20,000 pounds.

Write for a copy of this book to-day. It will result in decreased costs in handling.

Safety of Steel

The Triplex Block is steel construction—steel in all load bearing parts, sheave, gears, pinion, hooks and chain.

EACH BLOCK TESTED TO 50 PER CENT. OVERLOAD

Yale Products—Locks, Padlocks, Builders' Hardware, Door Checks and Chain Hoists.

Also Duplex Blocks, Differential Blocks and Electric Hoists

The Canadian Fairbanks-Morse Company, Limited

Montreal St. John Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver Victoria

"I don't care"

Many belt operatives express this sentiment when we show them their belts are improperly handled, unscientifically managed, and a cause of large money loss, which is preventable.

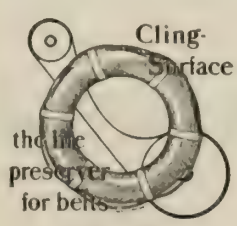
We advocate Cling-Surface treatment and slack running belts and guarantee best results obtainable. Still, after explaining the benefits derivable from slack belts from A to Z, offering valuable suggestions, and offering to take no money whatever for Cling-Surface if it doesn't do all we say, many men give little thought and often say: *"I don't care. My belts give me a lot of trouble, that's true, but I haven't time to think of them."*

The man who does care uses Cling-Surface and it pays him well

Every managing engineer who is keen as he should be in showing profits from his plant **must** give all the belting and transmission ropes systematic attention. And Cling-Surface treatment is the one logical method of constantly maintaining high transmission efficiency and prolonging the life of the whole transmission system.

Cling-Surface as a food to replace natural belt ingredients that become spent in service, makes and keeps the belting pliable and in best condition always. The soft, clean, clinging belt surface resulting from its use permits a slackening without slip, that produces even greater economies outside than inside the belt. Where the initial tension is thus eased, shafts, pulleys, hangers, bearings and their mountings are relieved of unnecessary stress, and there is a reduction in internal friction, of repair expense, lubricants and attention that make large annual savings—all due to the action of Cling-Surface.

Put Cling-Surface on just one tight belt for a trial. Select one that has been slipping badly, running off or wearing rapidly, and you will find Cling-Surface highly beneficial. Ask us for examples from plants where Cling-Surface has demonstrated itself to be indispensable. We quote f. o. b. Toronto.



Cling-Surface Co

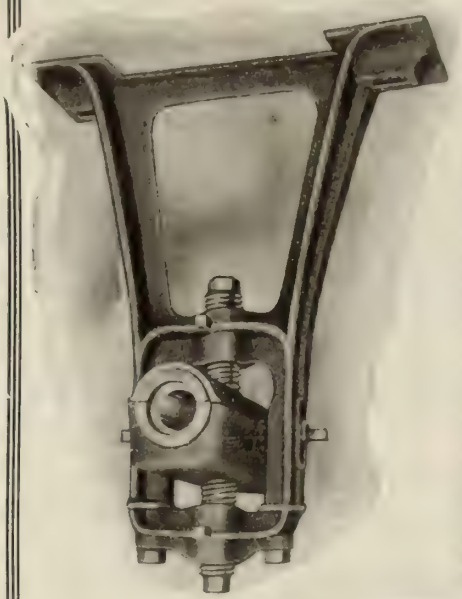
1057 Niagara Street
Buffalo N Y

69

ELMIRA

Ball & Socket HANGERS — **For MAXIMUM Service** — **Wood Split PULLEY**

AND BIG REDUCTION IN POWER TRANSMISSION COST



The "Elmira" Ball and Socket Hanger

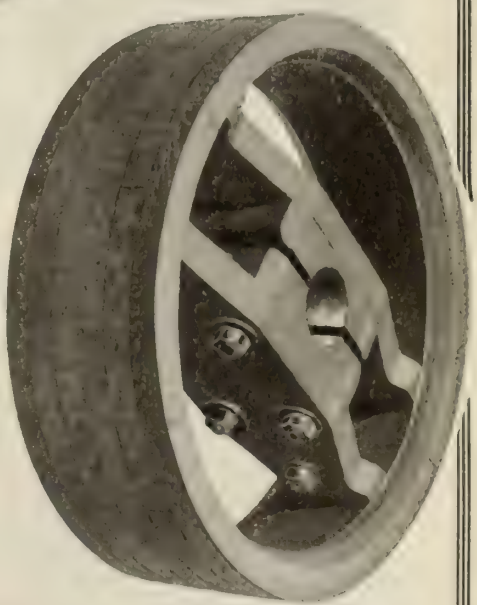
Is exceptionally strong and heavy. In this hanger a union system of oiling is employed, a combination of centrifugal and capillary attraction, effected by tempered steel rings and woven cotton distribution of lubricant, and precludes the slightest possibility of "Dry Bearings" so long as any oil remains in the reservoir or dry chamber, one filling of which should last from six to twelve months.

The "Elmira" Wood Split Pulley

You can use an "Elmira" Pulley any place that a leather belt will give satisfaction, and know that what any good pulley will do, it will do, and more.

This pulley **stands the hardest and most severe conditions.** It is nailed throughout. The arms are tenoned into rim and dowelled there.

Absolutely guaranteed.



It will be much to your interest to let us furnish you with our illustrated catalog. Write for it to-day.

Large and complete stocks carried at Elmira and by The A. M. Ellicott Co., 301 St. James Street, Montreal, Que., Sole Eastern Agents.

Elmira Machinery & Transmission Co., Ltd.
ELMIRA, CANADA

RIGHT HERE IS THE EVIDENCE!

L. S. DONALDSON

You Are Judge and Jury

Does the Jones Underfeed Stoker Save Coal?

Does it prevent Smoke?

You know the Verdict!

Then write us.

ALL CONTRACTS SUBJECT TO STRIKES, ACCIDENTS, OR OTHER CAUSES BEYOND OUR CONTROL.

DOMINION SUGAR COMPANY, LIMITED.

WALLACEBURG, ONT. May 30th, 1912

ADDRESS ALL COMMUNICATIONS TO THE COMPANY

Messrs. Jones Underfeed Stoker Co., Limited,
TORONTO, Ont.

Gentlemen,-

We are pleased to advise you that the installation of the fourteen Stokers which we put in our Berlin plant last year, has given the most perfect satisfaction. We operated our Refinery at that plant for about 65 days, and saved slightly over half the total cost of the installation.

We are also placing an order with you, to equip the balance of our boilers at that plant, to be ready for our fall run.

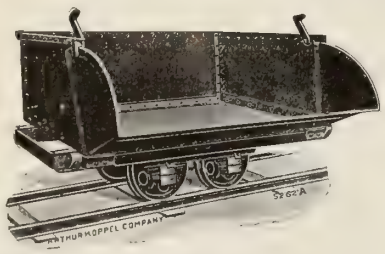
Yours truly,
DOMINION SUGAR CO., Ltd.

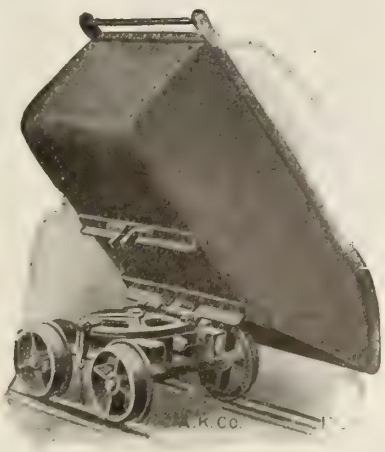
DAG/M

General Manager

JONES UNDERFEED STOKER CO., LIMITED

20 KING STREET E., TORONTO





A VERY satisfactory type of car for use in hauling ashes, dirt, etc., is the Scoop Car, which can be dumped either between the rails or to either side. Standard capacities are 12, 18 or 27 cubic feet for gauges of 18 or 24 inches.

How to Charge Furnaces Economically

A very important factor in the problem of keeping a constant supply of power is that of how to stoke furnaces efficiently. We are selling agents for a system of conveying coal and for charging furnaces in boiler rooms which requires very little labor and is practically indestructible. This system consists of the well known Koppel Cast Plate Track and Charging Cars.

ORENSTEIN-ARTHUR KOPPEL

Coal Charging Cars for the conveying of coal to boiler rooms are made of steel and are very durable. They are light in weight and easy and convenient to operate, being designed with special reference to boiler room service. The height of the cars is such as to make shoveling very convenient for the stoker. They may be supplied either with two side doors or end doors, as desired, and with or without swiveling base.

The rails of the track used in our boiler room systems are cast integrally with solid sectional plates, which provide a level surface to walk upon while car is being propelled.

We have a very interesting catalogue on this subject, showing many installations of the Koppel System, together with illustrations of cars, track, switches, turntables, etc., which we should like to send you. Ask for catalogue 412.

SALES AGENTS

The Canadian Fairbanks-Morse Co., Limited

ST. JOHN QUEBEC OTTAWA MONTREAL
TORONTO WINNIPEG SASKATOON CALGARY VANCOUVER

The Murphy Automatic Smokeless Furnaces

The NATIONAL CASH REGISTER CO., Dayton, Ohio, has had *17 years' experience* with Murphy Furnaces; gave *6 repeat* orders. Between their 5th and 6th orders for Murphy's tried-out another make of stokers—and they are out.

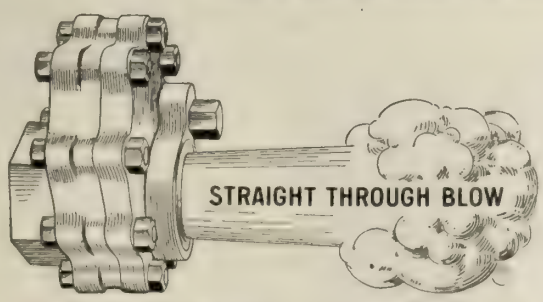
For their new CANADIAN CANADIAN CASH REGISTER CO., LTD., plant, TORONTO, ONT., they contracted for Murphy Furnaces.

"THERE MUST BE A REASON."

For printed matter address:

MURPHY IRON WORKS, DETROIT, MICH. BUFFALO, N. Y.

EVERLASTING
BLOW-OFF VALVES



IT NEVER LEAKS!
WRITE FOR PRICES

200,000 IN USE

Does your Boiler leak, Mr. Engineer?
How often do you blow it?
The "EVERLASTING" is the only perfect blow off valve on the market.
No stuffing box—requires no packing—is self-cleaning, and has a self-grinding seat—nothing to get out of order—What's the answer?

RELIABILITY—SIMPLICITY.

SOLD AND MANUFACTURED UNDER CANADIAN PATENTS BY

Engineering Specialties Company, 1080 King St., West, TORONTO
LIMITED

AGENTS

MONTREAL, QUE.
H. L. Peiler & Co.

ST. JOHN, N.B.
The A. R. Williams Mach. Co.

WINNIPEG, MAN.
The A. R. Williams Mach. Co.

CALGARY, ALTA.
P. D. McLaren Limited

VANCOUVER, B.C.
Taylor-Forbes Company, Limited

The advertiser would like to know where you saw his advertisement—tell him.

5 Big Features in one tool—

MANY die-stocks have **one** good point. Here is a die-stock with big points as well as a threading capacity of eight sizes of pipe.

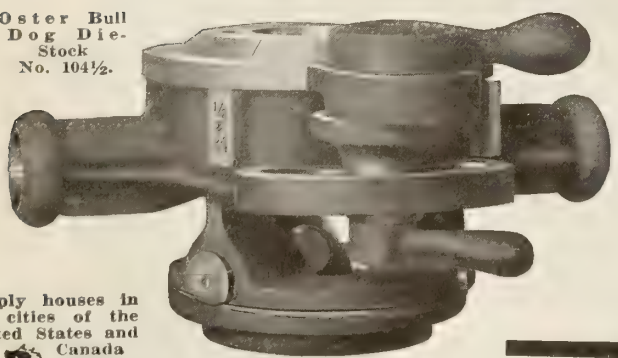
OSTER Pipe Threading Tool No. 104½

is one of the results of our twenty years' experience in the manufacture of pipe-threading tools. We have given this tool a splendid range of sizes, eight in all from ¼" to 2" besides the following Five Big Oster Features: (1) Self-locking dies controlled by a single lever-movement; (2) Self-locking guides—the famous lever-operated "Bull Dog Grip;" (3) No resetting after each cut; (4) No running back over newly cut threads; (5) No loose bushings to lose—No small parts to break.

Read in our illustrated booklet *"The Bull Dog Tale"* about the complete Bull Dog Line. Free to you by return mail.

The Oster Mfg. Co.
2099 East 61st Street,
Cleveland, Ohio

Oster Bull Dog Die-Stock No. 104½.



Supply houses in 251 cities of the United States and Canada carry Oster Bull Dog Tools.

Kindly send me by return mail *"The Bull Dog Tale."*

NAME .....
ADDRESS .....
CITY .....
STATE ..... (2099)

DURABLA

Registered Trademark Stamped all Over the Sheet

SHEET PACKING

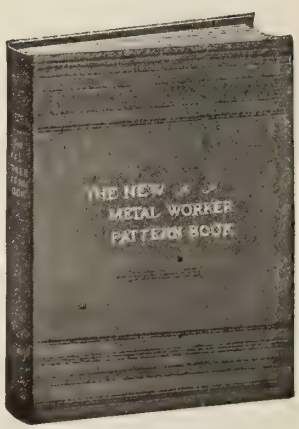
for Superheat and High Pressure, Wet Steam and Oil. It makes tight joints and keeps them tight. Never pulps! Never blows out!

Canadian Sales Agents
CANADIAN FAIRBANKS-MORSE CO., Limited
Montreal, Ottawa, Calgary, St. John, Toronto, Saskatoon, Quebec, Winnipeg, Vancouver.

Manufactured by
DURABLA MANUFACTURING CO. NEW YORK

The New Metal Worker Pattern Book

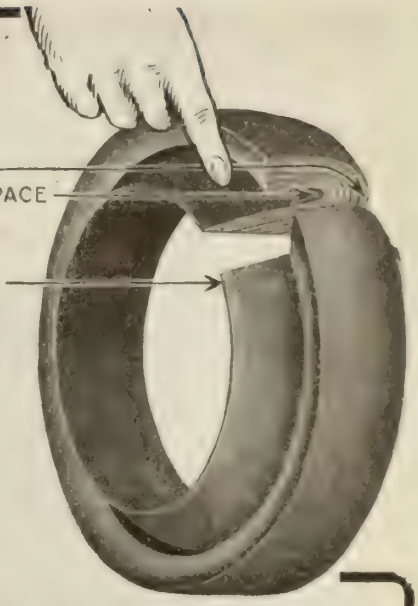
This is the most elaborate and complete work that has ever been brought out for the use of sheet metal pattern cutters. It is printed from new type with a new and improved arrangement, especially convenient for reference and study. Parts of a former edition, entitled The Metal Worker Pattern Book, which have been utilized in its preparation, have been re-written and simplified and later methods embodied. 218 problems are now given, 75 of which are entirely new. A Treatise on Pattern Cutting as applied to all Branches of Sheet Metal Work. By George W. Kittredge. 430 Pages; 744 illustrations; Size, 10 x 13 inches. Cloth bound, Price, $5.00. Sent postpaid only on receipt of price.



Technical Book Department

MacLean Publishing Co., Ltd.
143-149 University Ave., Toronto

This Lip Prevents Pressure Leakage—and Practically Eliminates Rod Friction



J-M Sea Rings are so constructed that the steam or other pressure behind the ring **prevents its own leakage.** In every ring there is a hollow space between the "lip" and the "heel" (see cut) into which the steam or contents of the cylinder flows, forcing the "lip" against the rod with **just sufficient** pressure to prevent leakage past the packing. When there is no pressure on J-M Sea Rings they do not press against the rod. So unlike ordinary soft packings, on the forward stroke they create no rod friction.

J-M SEA RINGS

on account of their automatic operation, actually eliminate 75% of the rod friction caused by ordinary packings. This effects a proportionate saving in coal necessary to generate steam or extra pressure required to overcome rod friction. And, in addition to the fuel saving, they increase the efficiency of the engine and eliminate unnecessary wear on themselves and on the rod.

J-M Sea Rings are light, durable, self-lubricating and never become soft or unduly hard. They are unaffected by acids, alkalies, or mineral oils. They are simple, easily applied and give the highest efficiency in their respective uses.

J-M Sea Rings are made of a laminated wedge of Asbestos or duck, turned over on itself. They withstand highest pressures and temperatures up to 600 degrees Fahr., and are the ideal rod packing for superheated or saturated steam, high-pressure hydraulics, marine engines, steam hammers, hot or cold water pumps, air compressors, etc.

Many other valuable features of J-M Sea Rings are fully explained in our illustrated Blue Book. Write nearest Br a copy.

THE CANADIAN H. W. JOHNS-MANVILLE CO., LIMITED

Manufacturers of Asbestos and Magnesia Products — ASBESTOS — Asbestos Roofings, Packings, Electrical Supplies, Etc.

Toronto Montreal Winnipeg Vancouver

1807

A busy paper mill making cheap steam without smoke or grits by the aid of "Bennis" machine stokers.

Cheap Steam for Industrial Undertakings

There are many Mills that are paying too much for their steam. With heavy fuel bills the boiler-duty is low and the boiler unable to respond rapidly to varying demands. Added to these troubles is that of a smoky and gritty chimney, the emission of smoke proclaiming imperfect combustion. "Bennis" Machine Stokers and Self-cleaning Compressed Air Furnaces reduce the coal bill, increase boiler-duty without detriment to the boiler, meet easily demands for rapid steam raising, maintain absolutely smokeless chimneys, and effect an all-round saving that makes their installation an investment.

A range of "Bennis" machine stokers increasing the steam output of water-tube boilers, and preserving boiler-life.

Write for **"Boiler-house Economy in Industrial Undertakings"** pamphlets, and full particulars to

GEO. H. TOD, 213 Manning Chambers, Queen St. W. **Toronto**
Winnipeg, 601 Union Bank Building

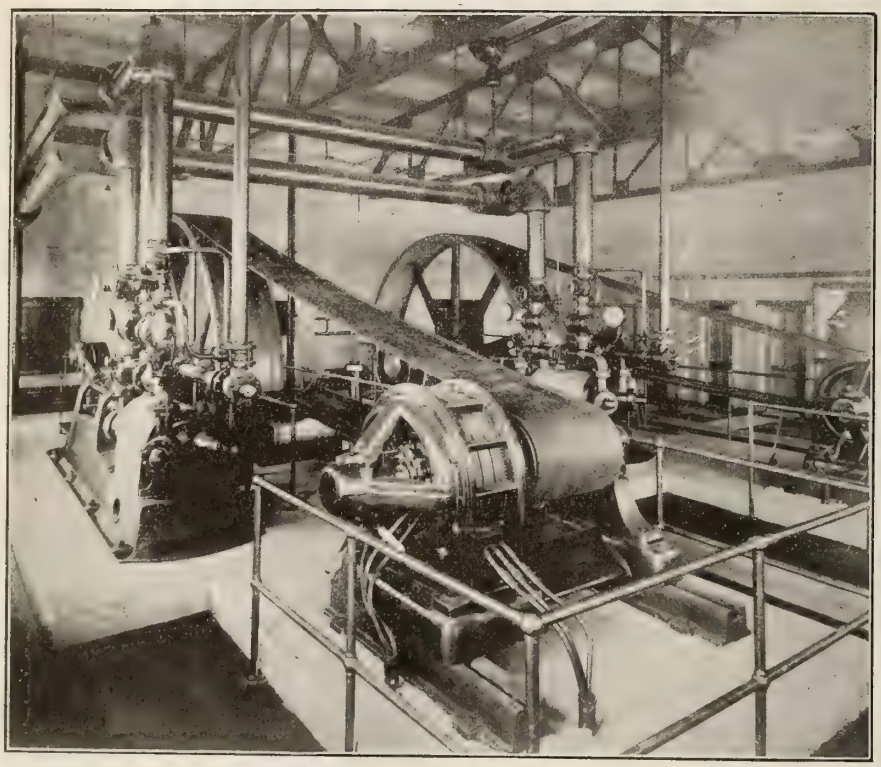
The advertiser would like to know where you saw his advertisement—tell him.

"THE LINDE"

REFRIGERATING and ICE-MAKING MACHINERY

CORK INSULATION

Over 8,000 Machines in use. Established and Manufacturing in Canada for 16 years.



Two 100-ton "Linde" Belt Drivers, Double Acting, Horizontal Ammonia Compressors Manufactured and Installed by us in Canada.

Recent Orders:—

McDONAGH & SHEA, Winnipeg, Man.

O. LECLAIR, Ottawa.

MUNICIPAL HOSPITALS, Winnipeg, Man.

CANADIAN NATIONAL EXHIBITION, Toronto, Ont.

C.P.R. VANCOUVER HOTEL, Vancouver, B.C.

C.P.R. CALGARY HOTEL, Calgary, Alta.

SWIFT CANADIAN CO., Montreal, Que. (2nd plant).

McGILL UNIVERSITY, Montreal, Que.

OTTAWA UNIVERSITY, Ottawa.

MR. J. A. PATRICK, Westminster Hockey Arena.

O. LESAGE, Montreal, Que.

AND MANY OTHERS.

The Linde Canadian Refrigeration Co.,

Limited

37 ST. PETER STREET, MONTREAL

Branch Offices—Toronto, 28 Front St. East; Winnipeg, 909½ Main St.; Vancouver, 42 Inns of Court Building; Edmonton, Walker & Barnes, 562 Second Street; Calgary, General Supplies, Limited, 1233 2nd St. East.

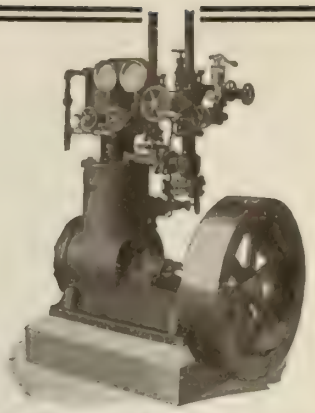
The advertiser would like to know where you saw his advertisement—tell him.

ESTABLISHED 1867.

THE VILTER MANUFACTURING CO.

242 BECHER ST., MILWAUKEE, WIS., U.S.A.

A small machine for small Ice-making and Refrigerating Plants, as well constructed and as successful in operation as larger outfits. VERTICAL SINGLE-ACTING AMMONIA COMPRESSORS, different sizes. Built with fewest possible number of parts. Sold at low price. Excels all others of like size in every point—simplicity, efficiency, reliability, smoothness of action, etc. We build horizontal and vertical ICE-MAKING AND REFRIGERATING MACHINERY, a full line of CORLISS ENGINES, and MACHINERY FOR BREWERS AND BOTTLERS. Our plant covers more than eight acres of ground.



Vertical Single-Acting Ammonia Compressor, Enclosed Type for Belt-drive.

The

LINDE BRITISH

Refrigeration Co. Limited

¶ Numerous fully authenticated laboratory tests organized from time to time in America and Europe, have invariably served to demonstrate in an unanswerable manner, the very remarkable degree of mechanical efficiency to which our products have been brought. ***The history of mechanical refrigeration is our history.***

Head Office: LONDON, ENG.

BIRMINGHAM	GLASGOW	JOHANNESBURG, S.A.
BRISTOL	BOMBAY	SYDNEY, N.S.W.
LIVERPOOL	CALCUTTA	PORT NAPIER, N.Z.

CANADIAN OFFICES
CORISTINE BLDG
MONTREAL

Self-Lubricating

In Cans
6, 12, 25 and 50 lbs.

SAFETY PLASTIC

METALLIC PACKING

FOR STEAM, WATER, AIR, GAS, ETC.
LASTS FOR YEARS AND NEVER WEARS THE PISTON ROD.

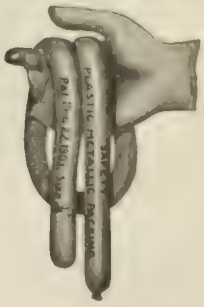
Guaranteed to stand steam temperature up to 550 degrees Fahr.
Guaranteed to stand hydraulic pressure to 5,000 pounds per square inch.
Packing furnished in bulk and in thin Cotton Tubes, sizes 3-16 to 1½ inch, 36 inches long, or in special lengths to fit your stuffing boxes.
Empty Cotton Tubing in assorted sizes FREE OF CHARGE with orders for the packing in bulk form.
The tubes are easily filled and they save you the expense of carrying a large stock of packings in different sizes.

Send for FREE SAMPLE and particulars.

Manufactured only by

STEEL MILL PACKING CO., WINDSOR, ONT.

Practically Frictionless



Any Quantity sent on APPROVAL

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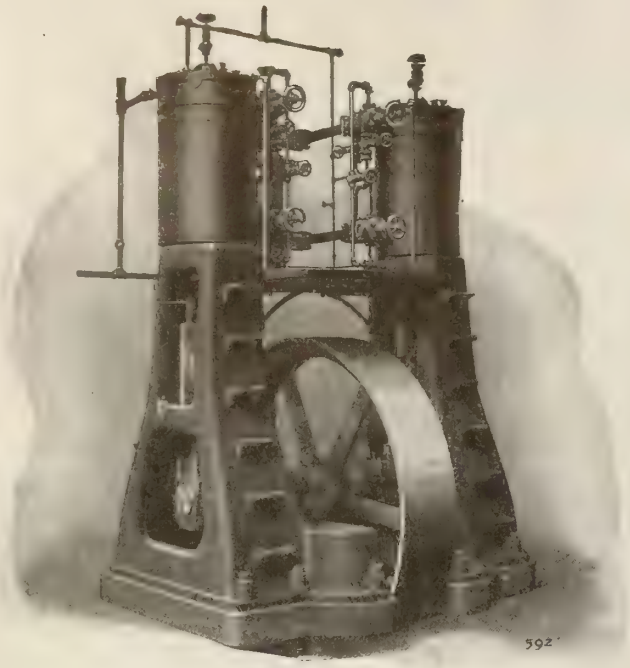


Steady Growth —

An Evidence of Merit

Each year, during the past seven years, has shown an increase in our annual sales.

No company can establish such a record as this—leading all competitors in the amount of annual sales—unless there is merit in its product—merit of the kind that wins new customers, and retains the confidence of old ones.

Our increasing sales, and the success attained by our plants, are ample assurance that your confidence in us will not be misplaced.

Fair dealing, prompt service, furnishing apparatus that will do all that we guarantee it to do, charging prices consistent with the quality of our product—all have helped to increase the sales of YORK Machinery and Apparatus.

A request for catalog, information, or prices will have our prompt attention.

YORK MANUFACTURING COMPANY

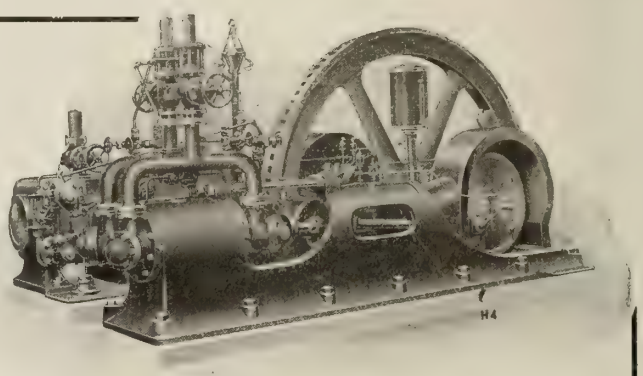
Largest Manufacturers of Ice Making and Refrigerating Machinery in the World

Main Office and Works: YORK, Pa., U.S.A.

Represented in the Dominion by **CANADIAN ICE MACHINE COMPANY**

TORONTO, 163-167 Yonge Street MONTREAL, 324 Coristine Bldg. WINNIPEG, 80 Lombard St.

FRICK



Refrigerating and Ice-Making Machinery and Equipment

is acknowledged the world over to have attained the highest degree of efficiency. For thirty-three years FRICK Machines have successfully endured the wear of exhaustive tests and proven all guarantees made.

It will pay YOU to KNOW US.

The FRICK is the only machine of which it can be said "There is no better machine built." The FRICK is durable—efficient and will last a lifetime.

We build all types of Refrigerating Machines—Vertical Single-acting, Horizontal Double-acting and Absorption.

WRITE FOR CATALOGUE TO

FRICK COMPANY, - Waynesboro, Pa., U.S.A.

KEITHS LTD., TORONTO NEW YORK CHICAGO PITTSBURGH CLEVELAND
ST. LOUIS DALLAS ATLANTA BALTIMORE BOSTON
United Iron Works: Oakland and Los Angeles Cal., and Seattle, Wash.

J. V. Jamison. President. T. B. South, Vice-President. J. V. Jamison, Jr., Treasurer.

The Correct estimated value of

A Refrigerator Door and Window

—is service.

1st. Efficiency
2nd. Strength and Durability.

Jones Cold Store Door Co.

Hagerstown, Maryland.

products combine and recommend to the trained and untrained eye, unexaggerated ability to perform its work and to stand up to its place. The construction object is in defiance to the

Slam Bang Laborers "Disable Me If You Can"

HINGES AND FASTENERS weigh 60 lbs. to the set. The Doors and Windows work as easy as the front Door on your dwelling.

They will not leak.

Refrigerator Doors and Frame and Windows mean shipped complete ready to set in the opening.

We guarantee our "AD" statements.

We believe a big part of our success is due to pleasing our Patrons.

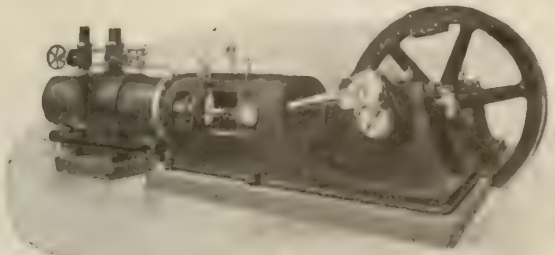
We are the sole manufacturers of the "NOEQUAL" DOOR with round jambs, so popular with the packing trade.

Our Revolving Ice Cream Door is a success for its purposes.

Our Ice Doors and Chutes do all that is required.

Jones Cold Store Door Co.

HAGERSTOWN, MD. U. S. A.



Arctic Electrically Driven

Ice plants are producing pure, crystal ice in cans, at a decreased cost for power and labor, and making a finer quality ice than the distilled water product.

This result is accomplished by installing our

Raw Water Ice Making Equipment

using the Arctic-Pownall System.

Any cheap motive power, such as water power, oil or gas engine, or electricity may be used.

Full particulars and printed matter will be mailed you — simply write us saying you are interested.

"We do it Right."

THE ARCTIC ICE MACHINE CO.

CANTON, OHIO, U.S.A.

You're Losing Money

If you are not using the best insulation in your refrigeration plant.

You Can Stop
That Loss At Once By Using Our

Corkboard Insulation

It is made of pure cork, and is recognized as the best insulation for cold storage and refrigerating purposes.

It is the only cork insulation that is made in Canada.

Write for full particulars.

Robinson Bros. Cork Co.,
LIMITED

HEAD OFFICE—803 LUMSDEN BLDG. TORONTO

FACTORY—
PORT COLBORNE, ONTARIO

The advertiser would like to know where you saw his advertisement—tell him.

5 REASONS WHY

The Huetteman & Cramer Co's Safety Compressor should be your choice!

1st. Because it is safest.
2nd. Because it is most reliable—Serviceable.
3rd. Because its working parts are most accessible.
4th. Because its design and construction make it stand the strains of strenuous service.
5th. Because it is most economical in consumption of power, ammonia and lubrication.

Get our new Catalogue B-3 and Booklet "Cold Facts"—it gives interesting facts and figures.

Write to

The Huetteman & Cramer Co.

Simple—Servicable—"Safety" Ammonia Compressors.

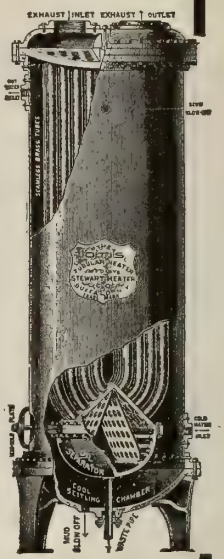
DETROIT - MICH.

Save Fuel and Increase Profit

A few engineers find this a difficult problem. They are not acquainted with

The "OTIS"

TUBULAR FEED WATER HEATER, OIL SEPARATOR AND PURIFIER



The exhaust steam when harnessed and passed through this Heater will heat the Feed Water to a boiling point before it enters the boiler. This effects an enormous yearly saving in fuel.

Write for descriptive catalog and prices.

The STEWART HEATER CO.

189 Norfolk Ave., Buffalo, N.Y., U.S.A.

DE LA VERGNE REFRIGERATING MACHINERY

We are prepared to furnish everything in the refrigerating line for Breweries, Cold Storage Plants, Packing Houses, Skating Rinks, Ice Plants (distilled or raw water systems), etc.

The name **De La Vergne** stands for **highest quality, maximum capacity, absolute reliability and permanent economy.**

Send for bulletin No. 1310

CANADIAN DE LA VERGNE COMPANY LIMITED

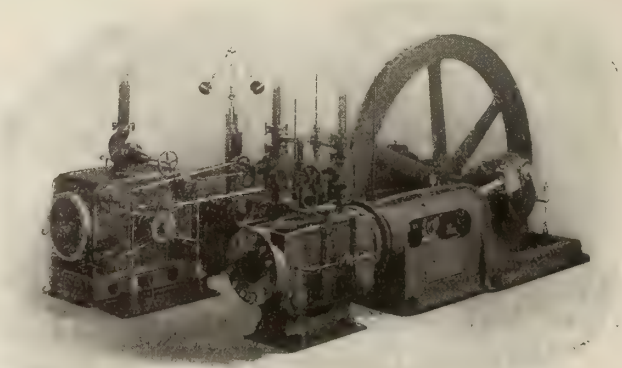
304-306 University St., MONTREAL, Canada

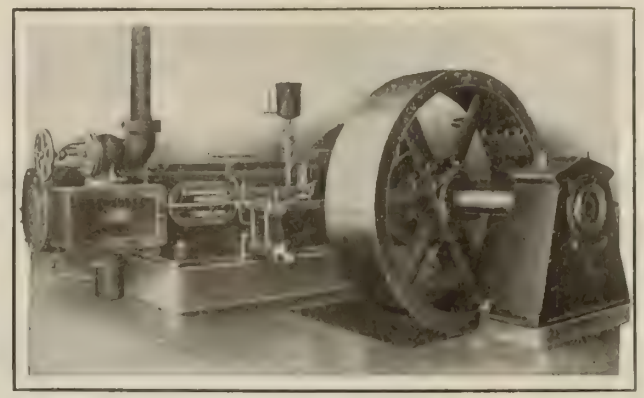
95 King St., TORONTO, Canada

is the standard of the world in the field of refrigeration. De La Vergne machines have been installed in all parts of the world.

We have been building refrigerating machinery for thirty years and **many of our machines installed over twenty years ago are to-day maintaining their high initial performance.**

Our long experience in this particular work enables us to furnish the best design equipment.





Side Crank Leonard Automatic Engines

Particularly adapted for Direct Dynamo Connection and Electric Light Service. Made in Simple and Compound Units up to 500 Horse Power. For High Economy and Close Regulation this engine is unexcelled.

We also make High and Slow Speed Corliss Engines for Heavy Duty Service. Our "Tangye" Engine is very well and favorably known throughout Canada for Sawmill Work.

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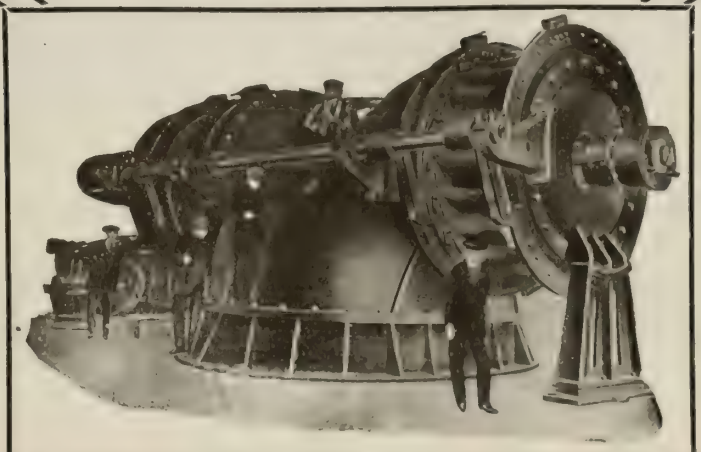

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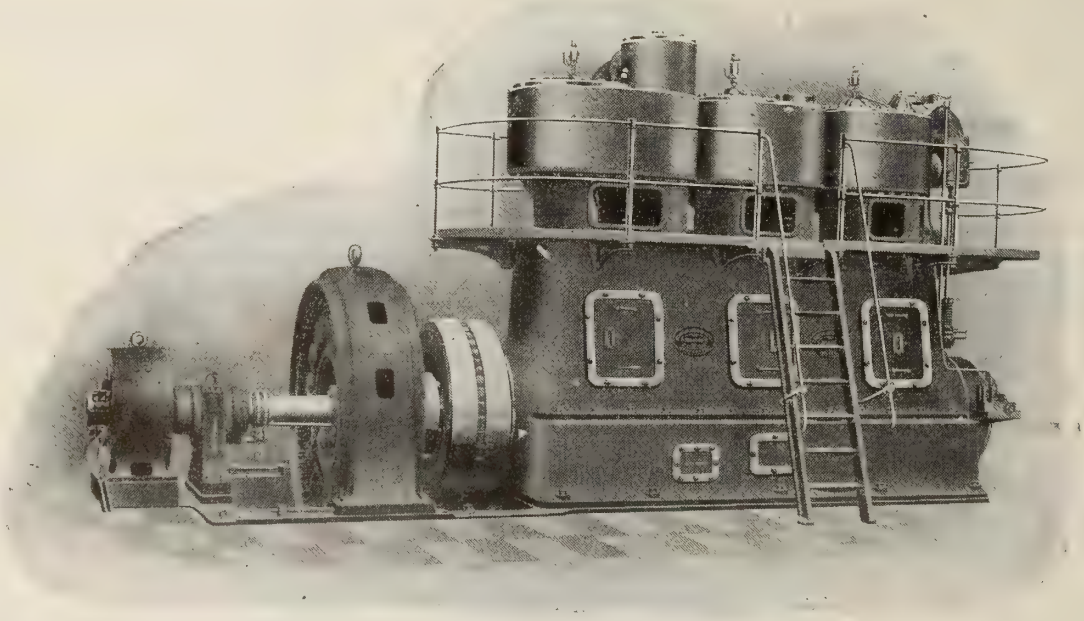

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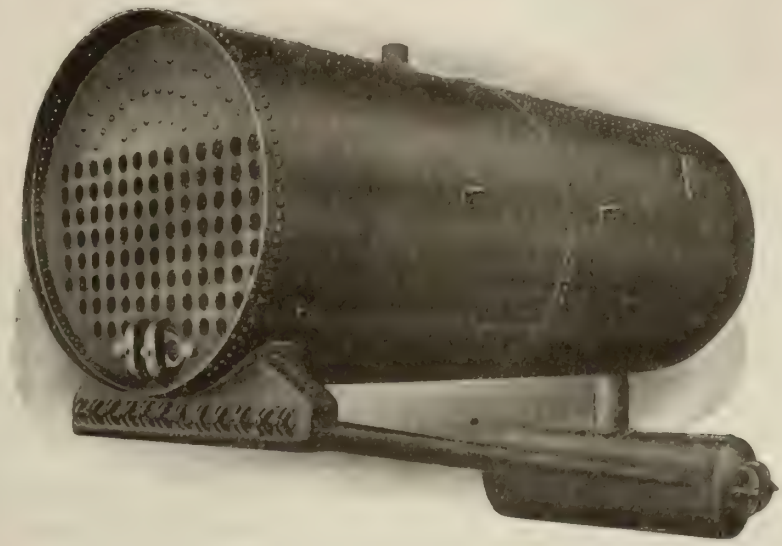


The Barrow Boiler

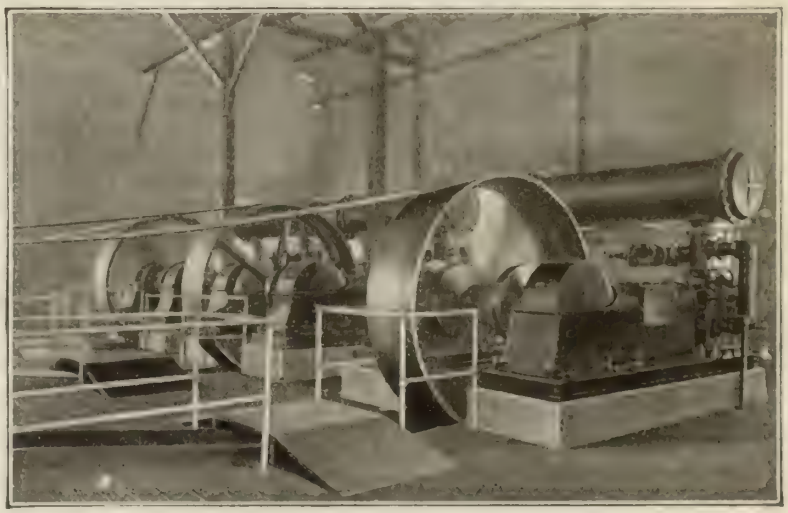
is a combination of fire and water tube construction.

At the rear of the boiler there be noticed a large drum, designed to take care of the mud and scale. As the water circulates down the back connection, mud and other sediment will collect in the bottom of this drum and can be blown off at the engineer's convenience. The drums are so built that there are no hand holes or plugs in the fire.

In the Design of

Blaisdell Air Compressors

all principal bearing surfaces are provided with flood lubrication, thus insuring freedom from trouble and resulting in absolute reliability of service. They are reliable, durable and efficient.



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Write us for your requirements in MICA

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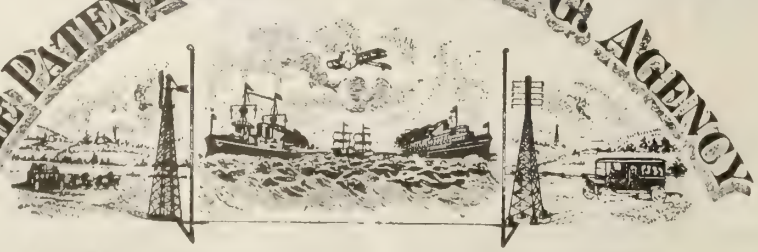

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Send Sketch for Free Report on Your Invention.

WRITE FOR PRICES AND TERMS.

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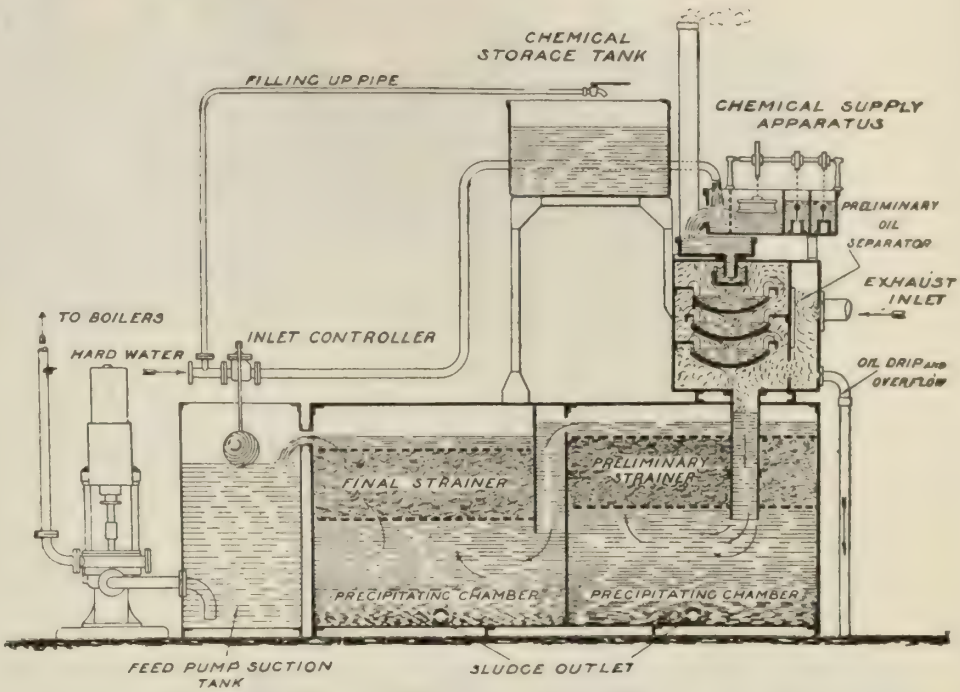
"PATERSON" Exhaust Heater, Softener, and Oil Eliminator

With this plant the temporary hardness is removed without the use of chemicals, the permanent hardness by the addition of sodium carbonate in accurate proportion to the amount of water passing.

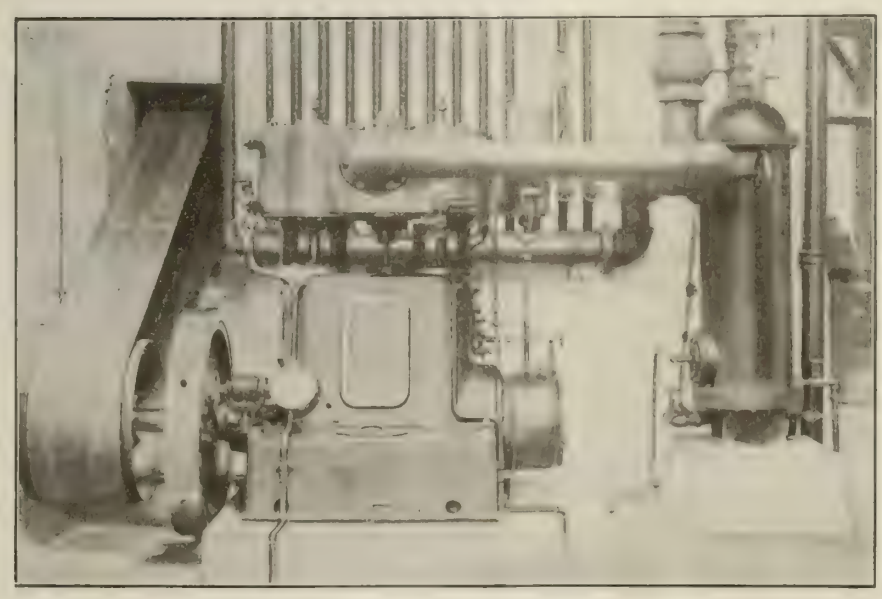
The oil and finely suspended matter is completely removed by the Paterson system of coagulation and filteration.



HEATER, SOFTENER AND OIL ELIMINATOR.

Manufacturers: PATERSON ENGINEERING CO., London, Eng.

"BELLISS" Engines, Turbines, Air Compressors



TWO CYLINDER COMPOUND ENGINE FOR BELT DRIVE IN A MONTREAL FACTORY.

Over 150 installations in Canada.

Among our customers we number the municipalities of

MONTREAL,
WESTMOUNT,
VERDUN,
FARNHAM,
BROCKVILLE,
RENFREW,
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Manufacturers: BELLISS & MORCOM, Birmingham, Eng.

Agents: LAURIE & LAMB, 211-212 Board of Trade, MONTREAL.

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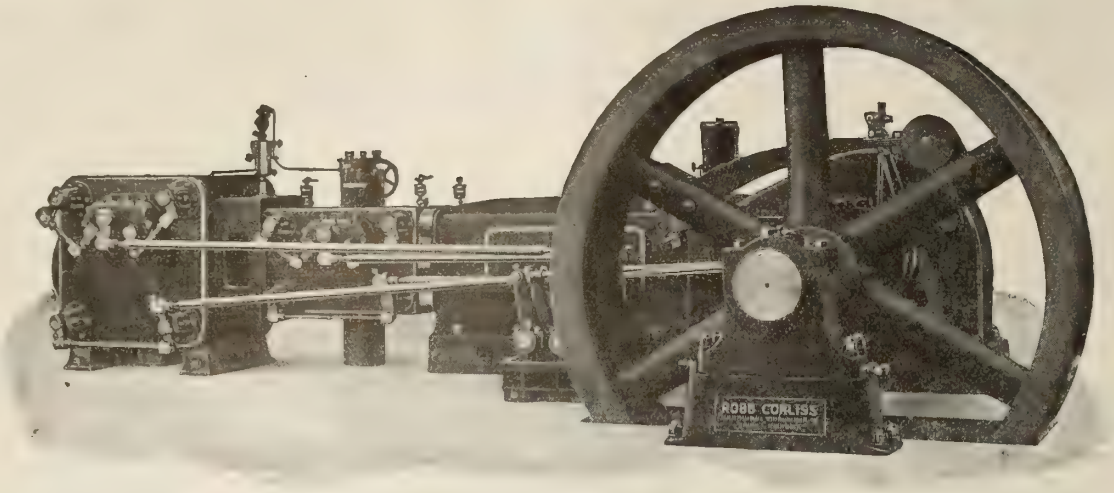
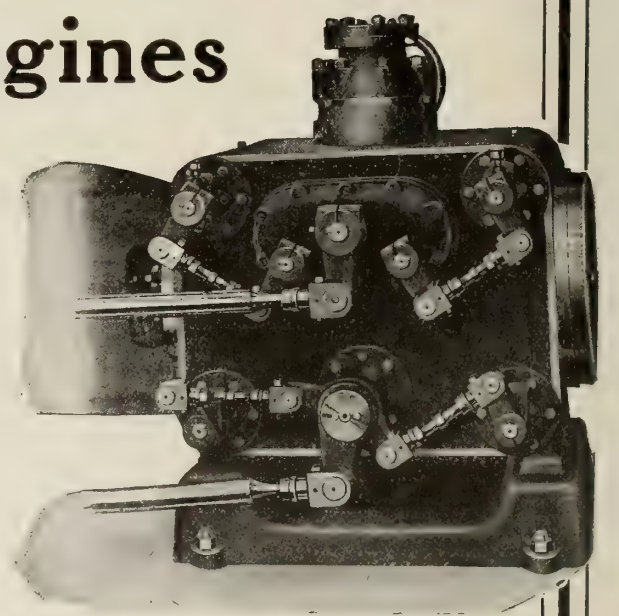


You can direct-connect THIS Corliss engine to your generator, for it will run at high speed—225 revolutions per minute.

It will give you a horse power on as little steam as any Corliss—you know what that means.

These features are not startling individually, but are remarkable in combination.

Robb Corliss Engines



have those features which give high speed —short stroke, multiported valves, and a valve gear that doesn't depend on a releasing mechanism for quick opening and closing. There are no springs, dash pots, latches, cams, or disengaging parts.

Yet the positive valve gear uses the steam almost perfectly, permits adjusting each event independently, reduces loss by having small clearances; in short, well-known Corliss economy.

A New Bulletin describing this engine is just out.

Ask for Robb Bulletin No. 202.

International Engineering Works, Limited

Manufacturers of

ROBB ENGINES AND BOILERS

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Grodwards Company, Cobalt, Ont.

AMHERST, N.S., CANADA

SO. FRAMINGHAM, MASS.

39-58

Some Advertising Advice.

¶ To make your advertising help your business, you must make it your business to help your advertising.

¶ Fancy a salesman calling on a very busy man once a week for a year, and saying exactly the same thing, wearing the same clothes and the same expression. Wouldn't he stand a fat chance of doing business? And yet there are men who will condemn advertising because it can't produce results under conditions which would be absolutely intolerable in the human salesman.

¶ You may not have the artistic ability to plan attractive layouts for your advertisements—few business men have — but you can say something about your line that no other man can say. Something that rings true, something convincing—something that will sell.

¶ Leave the planning of your ad. to our service department. Tell us what you want to say and put it up to our ad-writing department to dress it up for the occasion—effectively.

¶ Our ad-planning-writing service is second to none in Canada, and many of our most successful advertisers are taking advantage of it. Its services are free, and every advertiser or prospective advertiser in this publication is invited to employ its help.

¶ Remember this—cold type and illustration are representing your product — your house—your service. If the illustrations are poor, if your message is weak, the type arrangement unattractive, a poor impression is received by the readers of your advertisement. On the other hand, good illustrations, good copy and a good layout give a good impression.

¶ You can't afford to allow a poor advertisement to represent you, when our Service Department stands ready to help you.

¶ **If you want your advertising to make good, you've got to make it good.**

¶ And it **will** make good in The Power House if **you'll** do **your** share. **We're** prepared to do **ours.**

Rate Card and Full Information Gladly Furnished on Request.

THE POWER HOUSE

A Monthly Publication Devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power

143 University Avenue, TORONTO

G. & McC. VERTICAL QUICK REVOLUTION STEAM ENGINES

Will give you as they are giving others wherever installed

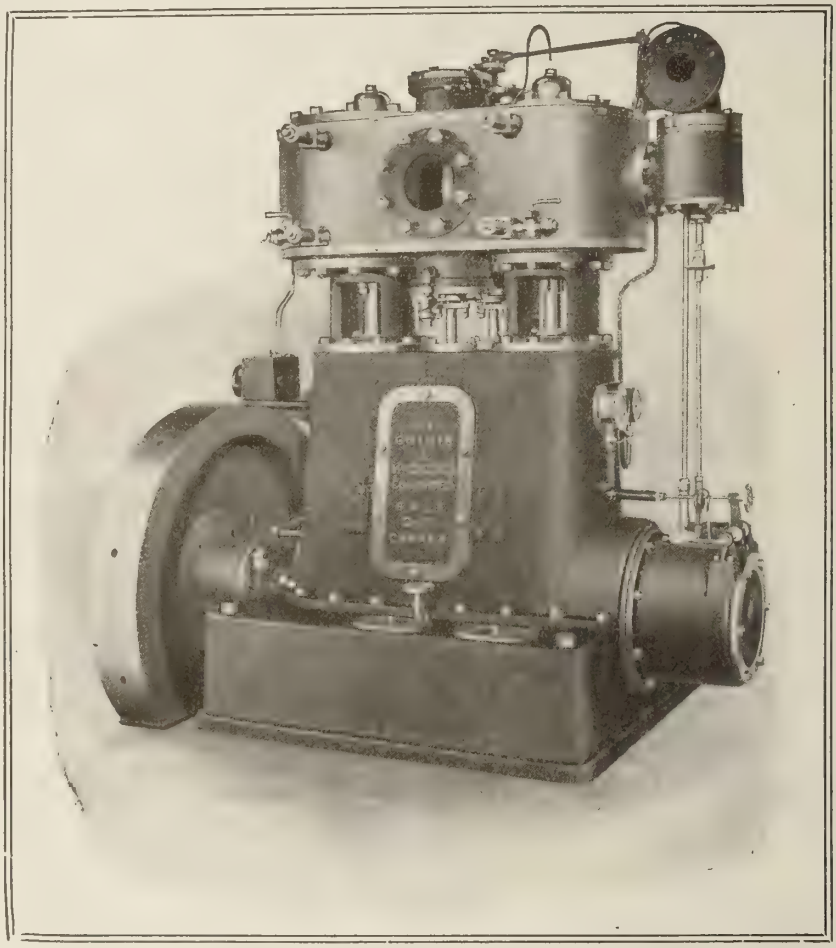
A MAXIMUM OF SERVICE

At a Minimum Cost of Upkeep

These Engines have a Perfect System of forced Lubrication.

They require little or no attention while running.

Built in all types and sizes.



They run with Practically no Noise or Vibration.

All working parts are very easy of Access.

Built to suit your Particular Requirements.

Two Cylinder Compound, Vertical Forced Lubrication, Quick Revolution Steam Engine, with Combined Throttle and Expansion Governor.

All the materials used in the Manufacture of Vertical, Quick Revolution Engines must be the best obtainable. In the construction of our Engines particular attention has been paid to this feature; the materials supplied being in accordance with **British Admiralty Specifications.** All Engines are tested under steam before leaving our works.

We shall be pleased to furnish Specifications and further information.

THE GOLDIE & McCULLOCH CO., LIMITED

Head Office and Works : GALT, ONTARIO, CANADA

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Can Ice Plant of the Ice Manufacturing Co., Ltd., Montreal

Staff Article

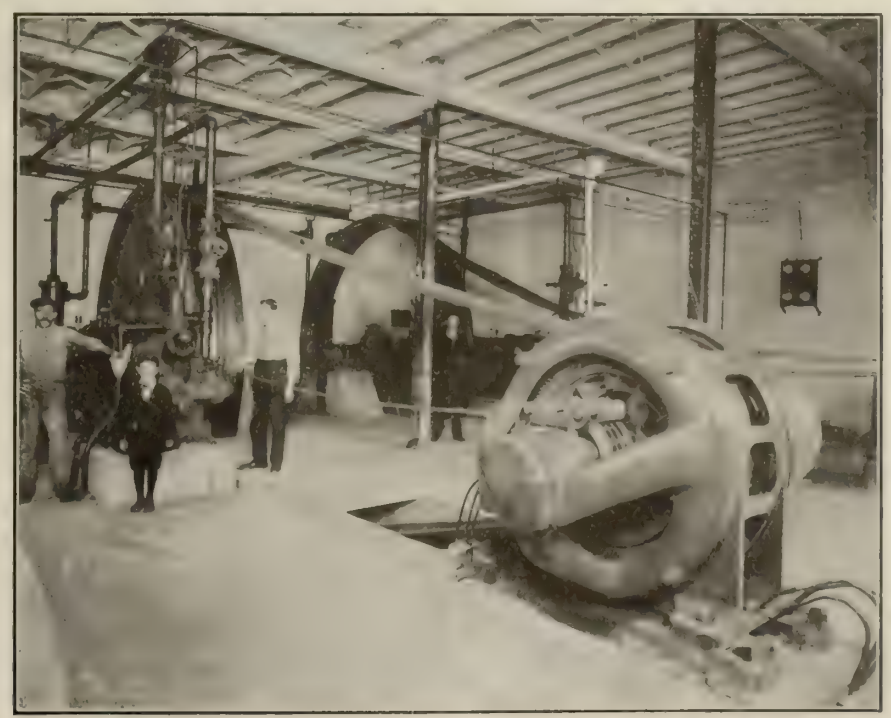
A description of the first Can Ice Plant to be established in the Province of Quebec. It is electrically operated throughout and has a daily capacity of seventy tons. The installation of multiple effect evaporation for distilling the water from which the ice is made is of considerable interest. The plant has been in operation for about seven months, with most satisfactory results.

UNTIL quite recently the city of Montreal was entirely dependent for its ice upon natural sources of supply, the chief of which are the St. Lawrence and Ottawa Rivers. Such a supply can never be entirely above suspicion, even although an analysis may show it to be apparently safe. A block of even the best natural ice cannot be melted without leaving behind a quite considerable amount of dirt and sediment—a fact which speaks for itself.

Believing that there existed a real demand for an absolutely pure ice to be used for general domestic and preservative purposes, a group of Montreal capitalists got together in December, 1912, and organized the Ice Manufacturing Company, Ltd., for the purpose of making can ice from distilled water. Shortly afterwards the erection of an up-to-date plant was commenced on a site in the eastern part of the city. The plant covers about an acre of ground, and consists of the ice factory, office building and stables.

The equipment installed is of 70 tons daily capacity, and is electrically driven throughout, with the exception of one or two pumps. Cheap electric power being available, it was thought best to adopt this system rather than drive the compressors, etc., by steam, using the exhaust for producing the distilled water necessary for ice manufacture. An electric drive also allows greater flexibility; and ice making plants being naturally much harder pressed in summer than in winter, this is an important advantage over a steam drive.

PLANT OF THE ICE MFG. CO., MONTREAL.



"TRIUMPH" 35-TON AMMONIA COMPRESSORS, ICE MFG. CO., MONTREAL.

The Evaporator Plant, Etc.

The water for ice making is distilled in an eight-effect evaporator plant installed by the Canadian Griscom-Russel Co., Ltd., Montreal. In the boiler house situated alongside the evaporator room is a single return tubular boiler to provide the steam necessary for operating the evaporator equipment. The boiler was built by E. Leonard & Sons, London, Ont., and is 72 inches in diameter by 16 ft. long. The water supply is derived from an Artesian well 1,000 feet deep, situated on the premises. The pressure is only sufficient to raise the water 800 feet, and an air lift operating under 100 lbs. pressure is employed to raise the water to the storage tank. The latter is of 4,500 gallons capacity, and is located on the roof of the building.

From the tank the water first gravitates to the ammonia condenser. From the pan of the ammonia condenser it is run to a small condenser in which the vapors from the last effect evaporator are condensed. Only part of the water is needed for condensing these vapors, the surplus being piped to two water softeners, to be later distilled. From the softeners the raw water goes to a

settling tank, and is thence pumped through flat coolers by a Blake-Knowles brass-fitted pump of the boiler feed type. The cold raw water passes through the inner pipes of the cooler, and distilled water passes through the outer pipes on its way to two charcoal filters and thence to the brine tank room. An exchange of heat thus takes place, the raw water being warmed up before entering the distillation plant, and the distilled water being cooled previous to freezing. It is still further chilled in the brine tank room, as will be mentioned later.

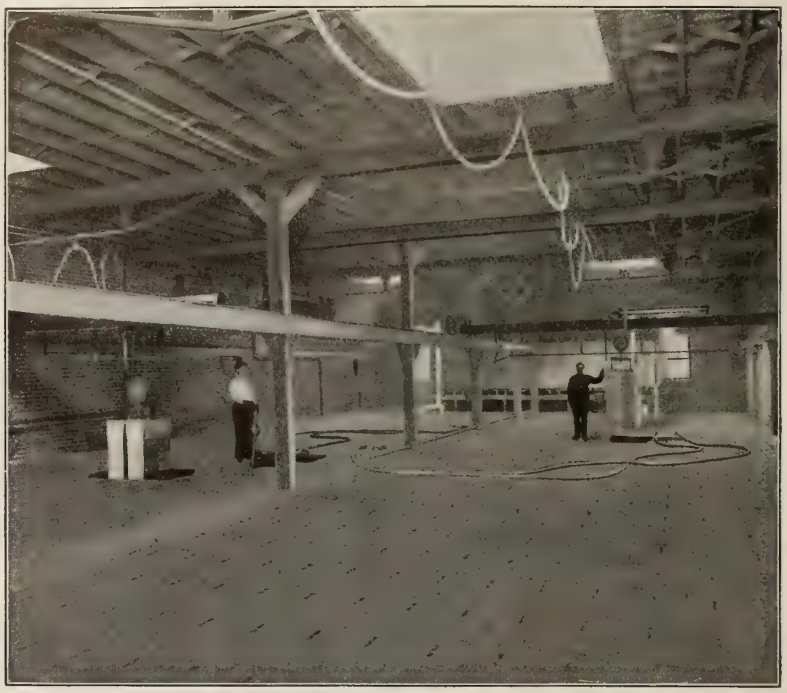
From the coolers the water passes through three low pressure heat exchangers, and thence to a pre-boiler. From this it is passed by a Deane 4 x 6 triplex pump, operated by a variable speed motor, through three high pressure heat exchangers, and thence through the eight evaporators. All the sweet water piping is of brass and the evaporator coils of copper. By means of a by-pass, any evaporator can be cut out for cleaning or repairs.

The Engine Room.

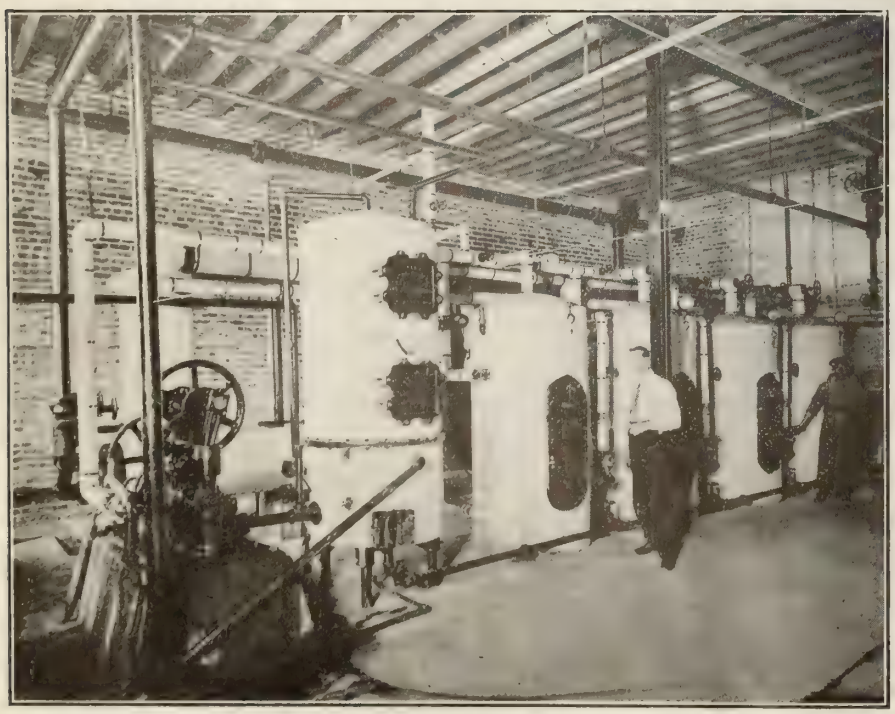
In the engine room are located the two ammonia compressors, and also the air compressor operating the air lift for the Artesian well. This air compressor is a 10-6½-8 two-stage tandem belt driven machine built by the Canadian Ingersoll-Rand Co. It is driven at 220 r.p.m. by a Canadian General Electric 20 h.p. induction motor, 60 cycles, 550 volts, and delivers the air at 100 lbs. pressure.

The ammonia compressors have each a daily capacity of 70 tons of refrigeration, and were built by the Triumph Ice Machine Co., Cincinnati, Ohio. Each compressor is of the horizontal, heavy duty, double acting type, with a cylinder 14 inches in diameter by 30 inches stroke. It is fitted with the Triumph geared stuffing box gland on which a circular rack engages with small gears which form an integral part of the stud nuts. By screwing up on any one of these nuts, equal force is applied to all, thus causing the gland to move in uniformly upon the packing. This form of construction, it is claimed, entirely prevents the various sections of the packing from becoming unevenly adjusted to the rod and sides of the stuffing box. The gland is lubricated by a small plunger pump driven by a round leather belt from the main shaft of the engine.

Each of the ammonia compressors is belt driven by a Canadian Crocker-Wheeler slip ring type, variable speed motor of 125 h.p. Three phase current at 2,200 volts, 60 cycles is purchased from the Montreal Light, Heat and Power Co., and is delivered as received to these two compressor motors. The latter are designed to run continuously at any speed between full speed and half speed, thus enabling the output of the compressor to be correspondingly varied.



ICE TANK ROOM, THE ICE MFG. CO., MONTREAL.



EVAPORATOR PLANT, ICE MFG. CO., MONTREAL.

The two compressors operate on one condenser located on the roof of the building. It is of the atmospheric type, and consists of 14 sections of 2-inch pipe, 20 feet long and 18 pipes high to each section. It is fitted with the latest water spray system.

The freezing system consists of two brine tanks 168 feet long by 20 feet wide and 47 inches deep. In these are suspended 986,300-pound ice cans. The brine is agitated by four vertical electrically driven 18-inch agitators, and, instead of being cooled by the usual direct expansion coils, is taken care of by two Triumph shell coolers. These consist of horizontal cylindrical steel drums fitted with tubes, and closely resemble return tubular boilers. They practically form enlargements on the ammonia piping system, and are operated so as to be always about three-quarters full of

liquid ammonia. By maintaining this level, the chance of entraining the liquid with the gas is practically eliminated, and at the same time the required amount of liberating surface is provided. The brine is caused to flow through the tubes of the cooler by the action of the agitators.

The confinement of the cooling agent to one part of the tank might be expected to cause more rapid freezing at the cooler end of the tank than at the opposite end; but numerous tests are said to have proved that, by applying correct principles to the agitation of the brine, there need not be more than one degree difference in the brine temperature in any part of the tank. A few of the advantages claimed for this system of brine cooling are:—

1.—The elimination of the ice tank coils, with a corresponding abolition of the numerous pipe joints.

2.—A reduction in first cost of equipment.

3.—Decrease in erecting and maintenance expense, owing to there being only six joints to make with any cooler, as compared with the very large number of joints in a coil tank.

4.—The ability to place the ice cans closer together, thus reducing the space required for a tank of given capacity.

The brine tank sides are insulated with 12 inches of granulated cork and the bottom with 3 inches of cork board.

Further Equipment.

The ice tank room is equipped with the usual traveller and pneumatic hoist, two skeleton ice dumps with dip tanks, can filters, etc. The distilled water for filling the cans is carried in a raised tank at one end of the room. This tank is fitted with direct expansion coils, by means of which the temperature of the water is reduced to about 36 degrees F. before it passes to the cans.

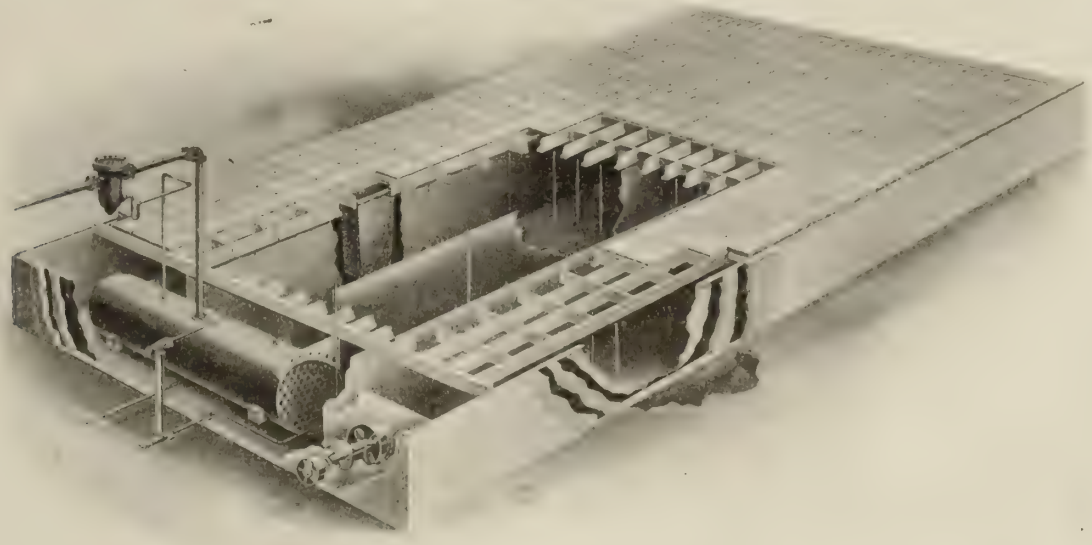
The storage rooms are three in number, and are cooled by direct expansion coils suspended from the ceiling in the usual manner. From the dip tanks the ice is conveyed by chutes to the middle room, and thence distributed by hand labor to the other two rooms. The walls of all three storage rooms are insulated with 3-inch cork board. The floors are of concrete, on top of which is laid 3 inches of cork and 1½ inches of asphalt.

System of Distribution.

Instead of charging their clients a flat rate for domestic ice, as is so generally done, the Ice Mfg. Co., Ltd., have adopted the coupon system, whereby householders are enabled to obtain just as much or as little as they desire and day. Moreover, the company's drivers deliver the ice right into the refrigerators, instead of dumping it upon the sidewalk. The men are absolutely forbidden to accept gratuities for this service, and the system is found to be extremely popular with consumers.

Officials of the Company.

The officials of the Ice Manufacturing Co. are as follows:—President, W. T. Rodden; Vice-President, F. W. Molson; Managing Director, H. R. Drackett; Directors, Lt.-Col. J. Carson, Lt.-Col. A. E. Labelle, Lt.-Col. E. W. Wilson, and Harry F. Cook.



APPLICATION OF THE TRIUMPH SHELL BRINE COOLER TO AN ICEMAKING TANK.

Alberta Hydro-Electric Co., Ltd., incorporated at Ottawa, capital $1,000,000, to use and supply water and water power for any of the purposes for which the same may be used, at Calgary, Alta. Incorporators: Frederick S. Albright, Arthur L. Smith, etc., Calgary.

BOILER ROOM EFFICIENCY.*

By D. F. Beeman.

OF any one part of your plant, that which will pay the largest dividends per energy and knowledge invested is the boiler room. The value or importance of boiler room efficiency, I believe, is greatly underestimated by the average engineer and by manufacturers in general.

From close observation in plants where I have been employed, also in plants it has been my pleasure to visit, noting methods and equipment, there is very little doubt but what 98 per cent. of the plants in operation to-day could reduce their fuel cost at least 10 per cent., and a number of them as high as 30 per cent. This result could be accomplished by better methods of buying fuel and more scientific methods of operating furnace and boiler.

The question of maximum economy is a question of right methods. Combustion is a chemical operation, but efficiency does not depend upon forced draught, induced draught or natural draught, but upon co-operation and management of the boiler room and boiler room employees, instructing them intelligently and letting them know just what is necessary to obtain economy, and this is what you expect of them. Equally as good results have been obtained from one system of draught as from the other; it is only local conditions and the kind of fuel used that give either system the advantage.

Considerations Affecting Results.

The value of any fuel is the amount of heat units this fuel contains, and the cost of fuel should be considered as buying so many heat units. The selection

*From a paper read recently at the South Western Ice Manufacturers' Convention.

of a fuel for use in any power plant should be the first step towards economy. By this I mean buying fuel that will give the greatest average B.t.u. as fired per dollar, laid in your boiler room, and the ability of the company selling same to be able to deliver it to you in such quantities as your plant may need at different times of the year. It has been my experience that you can't get much heat out of car numbers and promises. Firemen get much better results when using one kind of fuel continually. When changing fuel, the method of firing will have to be changed. This is detrimental to efficiency, because firemen, like most of us, are victims of habit; when used to firing one way it is hard to get them to make a change from one to another and fire efficiently. I have special reference to changes from lignite to bituminous coals.

Combustion Process Records.

After deciding what fuel you will use it is then a question of converting this heat to some useful purpose. You cannot expect maximum efficiency in your boiler and furnace unless you know just what is going on; guessing on this matter has proved expensive. There are a great many questions to be answered in regard to furnace operation, before you can expect good results. Have I too much or too little draught? What is the temperature of escaping gases? Is fuel bed too thick or too thin? How much excess air am I heating? No man regardless of his ability, can get the best results without a flue gas analysis instrument, draft gauges and flue gas thermometers.

Just to illustrate:—In calculating the heating value of mixed fuels the value of carbon is commonly taken at 14,600 B.t.u. The heating value of carbon burned to carbon dioxide at 14,600, and that of carbon to carbon monoxide at 4450, the difference 10,150 is the heat loss by imperfect combustion. The difference between 14 per cent. CO_2 and 4 per cent. CO_2 is 33 per cent. loss in furnace efficiency, and the greatest part of this is a preventable loss. When burning your fuel so that escaping gases will analyze 14 per cent. CO_2, there are only three places that heat can go:—Into the water in boiler; up the stack; or be lost in radiation; and if your escaping gases analyze 14 per cent. CO_2 and are not over 150 degs. F. above steam temperature, and boiler is clean inside and out, boiler and furnace efficiency is assured.

Another thing I would like to call to your attention. We have been trying to educate our men to keep an even boiler pressure. Installing damper regulators, etc., charts from recording steam gauge, was a thing of art. When the pressure rises the damper closes and you cut off the air. The furnace then generates carbon monoxide 4450 B.t.u. per pound of carbon instead of carbon dioxide 14,600. You practically turn your furnace into a gas producer. Just figure out some time how little you lose by dropping your steam pressure five or ten pounds and how much you lose by dropping your CO_2 from 14 per cent. to eight, or lower, by imperfect combustion.

Burning Lignite.

For the past year, 1913, I have burned lignite, using forced draft. Forced draft is the ideal combination in connection to hand fired furnaces burning lignite. The problem to be solved in a large plant using lignite is increased labor cost. The handling of this fuel is quite an item, including ash. This coal beng non-coking, a special grate bar is necessary to keep from losing too much of it through grate bars. The grate used in the plant I have reference to was designed especially for lignite of the type commonly called herring-bone, which would burn either lignite or slack coal. Forty square feet heating surface to one square foot grade surface was decided best suited to our purpose. The bridge wall was built four inches higher than standard for bituminous coal. This was done to get a thorough mixture of gases before leaving furnace.

Thermometers were installed in the uptake and close attention paid to escaping gases. The temperature of escaping gases was not allowed to go above 600 deg. F. A. Hays improved gas collector and gas analysis instrument was used, analyzing gases at regular intervals, and getting average sample, which was between eight and ten per cent. CO_2. Instantaneous readings with conditions right went to 14 per cent. CO_2. An Allison differential draft gauge was used and so piped that a reading could be taken in all uptakes and in ash pit. The draft in the uptake was never allowed to go above .4 inch, and averaged .35 inch. The forced draft was regulated according to thickness of fuel bed.

I found it impossible for men to fire a hand stoked furnace with a perfectly balanced draft on account of intense heat; also the flame will lick out every time additional fuel is added. With the conditions I have named, including increased labor cost when using lignite, a creditable decrease in fuel cost was made against fuel oil which we used the year of 1912 at 84 cents per barrel f.o.b. boiler room.

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Kilmer, Pullen & Burnham, Ltd., electrical engineers, Toronto, have changed their name to the Swedish General Electric, Ltd.

RECIPROCITY IN BOILER INSPECTION.

TO avoid any possibility of their boilers being penalized as to pressure allowed, the firm of Baldrig, Yerborough & Hutchinson, of London, Eng., who have secured the contract for Section No. 2 of the Welland Canal, have offered to pay the traveling expenses of a Government inspector to England and back, so that any boilers found under standard may be replaced. It is not likely that the Ontario Government will do this, as the boiler inspection staff have plenty of work to do at home. The provincial boiler inspection regulations only came into force on July 1, so that there are scores of boilers in Ontario waiting to be inspected. It is work that requires doing immediately, as three recent serious boiler explosions prove. Up and down the province there must be a large number of boilers which have passed their useful stage, and are not fitted to stand the steam pressure being used. The boiler in the Manley Chew sawmill at Midland, Ont., which exploded last month and killed two men, was one of them.

It is very hard to see the necessity of sending a Government inspector to England to inspect boilers so that the contractors may save the expense of sending inadequate ones out. It is safe to say that if they pass the test of the British Government they will pass muster in Ontario. It would be a dangerous precedent too. Another firm might want to send a Government inspector to Siberia, which would be just as reasonable. Some day there may be reciprocity between the Mother Country and the Dominions in this matter, when a boiler which can be operated at 95 lbs. pressure in Great Britain will be permitted to do the same in Canada. Something along that line is being planned now in Canada. Mr. D. M. Medcalf, chief boiler inspector of Ontario, has been instructed by his Minister to communicate with the Departments in other provinces to have their representatives meet in Toronto in January, to discuss the question of interprovincial reciprocity in boiler inspection.

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E. Leonard & Sons, Ltd., London, Ont., makers of engines and boilers, have supplied an engine at each of the following points on the National Transcontinental Railway: Edmundston, N.B., Napadogen, N.B., Moncton, N.B., Parent, Que., St. Foye, Que., Grant, Que. The first mentioned three engines are erected and ready to commence operations. They are now erecting the one at Parent and the one at St. Foye has just been shipped. The Commission are not yet ready to receive the engine at Grant.

Auxiliary Machinery Problems in a Steam Turbine Plant*

By Heinrich Treitel

Every owner or designer of a steam turbine plant is faced with the question, when carrying out the preliminary work as to which system of driving is most suitable for the condenser auxiliary machinery—that is, for the air, condensed water, and cooling water pumps. The following particulars are intended to serve as a guide in this selection.

THE question of the most suitable form of drive for the condenser auxiliary machinery must be preceded by the determination of the condenser and pump system to be adopted. In the majority of cases, surface condensation, notwithstanding the higher initial cost, offers such obvious advantages that it is not necessary to refer specially to jet condensation here; it will suffice to say that the principal points to be considered in selecting the pump drive for surface condensing plants also apply in general to jet condensation. The decision as to whether plunger pumps or bucket wheel pumps (so-called rotary pumps) are to be employed already touches upon the system of driving.

Pump Types and Drives.

Dry slide valve pumps which were originally driven by reciprocating steam engines, and later by electric motors by means of belt transmissions, belong to the past; at the present day the only plunger pumps which have survived are the high-speed, multi-stage wet air pumps, which are constructed without exception in the vertical form. These pumps are always driven by electric motors, preferably direct-coupled, although chain and belt drives are occasionally employed in order to reduce the cost of the installation. The latter forms should be avoided on principle, however, as it is a mistake to lessen the reliability of a plant by introducing such transmission gear which, in addition, occupies an appreciable amount of space and does not operate noiselessly.

Wet air pumps have maintained their position as reliable auxiliary machines, and, when preference is given to an electric drive in combination with electrically driven centrifugal pumps for the cooling water circulation, compete with the rotary condensed water and air pumps, to which they are superior as regards their energy consumption. Apart from the exception just mentioned, therefore, the following particulars relate exclusively to rotary pumps. In reality this latter type rules the market at the present day; the small space which they occupy, their reliability in operation, and their comparatively low manufacturing cost allow the fact that they only have a moderate efficiency to be overlooked.

Both the air pump and the condensed water and circulating pumps of the rotary type can be built for speeds which permit them to be driven by standard high-speed electric motors or small steam turbines. Great variety in the forms of construction can be obtained on account of the fact that these different pumps can be mounted together or separately; they may also be driven by a motor or turbine, and, in addition, may be erected at different heights.

It must be borne in mind that the cooling water pump must never be placed at a greater height than that necessitated by the maximum permissible suction head, so that under certain conditions the pump must be erected at some distance from the central station at the place from which the water is obtained. The air pump, on the other hand, can be erected at any desired height, while the condensed water pump must always be placed below the lowest point of the condenser. If the combinations which are not customary or are unsuitable on economic grounds are neglected, the following cases remain to be considered:—

(1)—All pumps mounted on one shaft, and driven by an electric motor.

(2)—All pumps mounted on one shaft, and driven by a steam turbine.

(3)—All pumps mounted on one shaft, and driven by an electric motor and steam turbine.

(4)—Pumps mounted on a number of separate shafts and driven by electric motors.

(5)—Pumps mounted on a number of separate shafts and driven by electric motors and steam turbine.

Plant Reliability Feature.

The selection of the most suitable arrangement and most satisfactory drive must be decided after due consideration of the space required, installation costs, economy and reliability in operation. Starting from the understanding that the reliability of the plant is the point of chief importance, the circumstances relating to this point must undoubtedly receive first consideration. Mechanically, electric motors and steam turbines may be said to possess an equal degree of reliability; this is scarcely the case, however, as regards the reliability of an uninterrupted supply of energy.

Whereas it may be assumed that the supply of steam will be continuous under all conditions, apart from unavoidable accidents, the current in the central station may be cut off entirely upon the occurrence of a short-circuit in the busbars, so that all the electric motors connected up to them will come to a standstill. Heavy voltage fluctuations may also cause the auxiliary machinery to stop. For the cooling water circulating pump and condensed water pump, a temporary cessation of the service of short duration is of no importance, as some time is taken to heat the water in the condenser to such a degree that dangerous results make themselves apparent, and the condensed water will only fill the condenser steam chamber gradually.

Air Pump Stoppage.

The stopping of the air pump is more critical, however, and liable to give rise to much trouble, as the evacuation of the condenser and the turbine casing always entails a certain amount of time, and the rapidity with which the turbo-generator can be started up again is dependent upon it. Moreover, rotary pumps, particularly when they are not of ample size, are slower in this respect than plunger air pumps. Very low figures for power consumption should, therefore, always be regarded with the necessary caution.

Arrangements for enabling a non-condensing service to be carried on for a longer period, such as are very popular in smaller plants to increase the reliability of operation, are out of the question even for medium size machine units, since the boilers cannot generate the large quantities of steam required, and on such occasions are strained to the limits of their capacity. The consequences are well known: Priming of the boiler, fouling of the turbines and, therefore, reduction of their efficiency and output until they are cleaned again.

Electrically-Driven Air Pump.

The air pump can, therefore, only be driven electrically without hesitation when an interruption in the current supply of the motor need not be feared. For these reasons a special machine is sometimes found in every large central station for the independent current supply of the auxiliary machinery and also provides current for driving the mechanical chain grate stokers, which must not be allowed to come to a standstill, as the boilers must give their maximum output when the air pumps have stopped.

This solution appears somewhat ques-

*From the A. E. G. Journal."

tionable, however, from an economical point of view; the possible necessity for a stand-by machine must also be taken into consideration. In some works, two kinds of current are generated, as, for example, direct current in addition to three-phase current. In such works the motors for the auxiliary machinery are connected up to the direct-current mains, which are independent of the large three-phase generators, and thus an appreciable increase in the reliability of the service is secured. When starting up the machines again the work can be accelerated if the motors for the auxiliary machinery are not branched off from the bus-bars, but are connected directly to the terminals of the main generator, and started up simultaneously with the latter.

Steam Turbine-Driven Air Pump.

Although a steam turbine drive undoubtedly deserves the preference as regards reliability of operation, on account of the foregoing reasons, on the other hand, the electric drive is, as a rule, more economical. The steam drive only possesses an unquestionable economic superiority when the exhaust steam of the auxiliary turbine can be employed for heating purposes. Such cases form the exception, however, since, as a rule, only the preheating of the feed water comes into question, and an ample supply of exhaust steam for this purpose is already available from the driving machines (reciprocating engines or turbines) of the feed pumps.

The common practice is to allow the exhaust steam from the auxiliary turbine to enter a stage of the main turbine of suitable pressure, and thus do further work in the low pressure portion of the main turbine. The high pressure stage of the main turbine is then supplied with a correspondingly reduced quantity of live steam, while the low pressure portion has to do more work. The auxiliary turbine, therefore, represents an imperfect turbine high pressure part which is connected up to an excellent low pressure section with a perfect condensing plant.

With this normal arrangement the quantity of steam required for the useful kilowatt-hour supplied must be greater than for an electric drive, if the power necessary for the condensing plant is also included—that is, if the motor or motors are not considered as belonging to the secondary plant. On this account, particularly in industrial plants, a careful investigation should always be made in order to ascertain whether the exhaust steam cannot be used for heating purposes, even if only in part or temporarily; in this manner the energy required for driving the pumps will be obtained as a by-product practically free of cost.

On the other hand, in heavily loaded plants, a turbine drive for the auxiliary machinery offers the economic advantage that the full nominal output of the main generator can be devoted to supplying the mains, while with an electric drive the energy absorbed by the auxiliary motors must be deducted from this output

Combination Turbine and Electric Drive.

These considerations in connection with the working reliability and economy have caused the frequently suggested proposal to be adopted of driving the air pump, as the most important organ, by a steam turbine, while the circulating pump for the cooling water is coupled to an electric motor. The condensed water pump is frequently combined constructionally with the air pump; in other cases it is provided with a special small motor, or must be connected to the circulating pump. The most perfect solution of the task is, therefore, undoubtedly to be found in driving the pumps mounted on one shaft by a turbine and electromotor in such a manner that the turbine can be uncoupled by means of a disengaging coupling; the pump set can thus be started up at any time independently of the electric mains. In permanent service the drive is carried out by the electric motor placed between the turbine and circulating pump in an economical manner, the latter can be relieved by the turbine, however, in case of need.

Installation Costs.

The question of the installation costs for the various forms of drives should be of secondary importance when compared to the above discussed points in connection with reliable operation and economy, even when it is not a case of small sums which are of very slight importance in comparison to the cost of the entire plant. It may be said that in general the installation costs for the steam turbine drive are somewhat higher than for the electric drive. The mixed and double drives naturally entail a corresponding increase in the cost. It should also be mentioned that the condenser cooling surface has to do more work with the turbine drive than with the electric drive, corresponding to the greater quantity of steam to be condensed at full load.

Space Requirement.

The question of space required is likewise of minor importance; only in exceptional cases will a system, selected on grounds of reliability and economy, have to be abandoned owing to difficulties in erection. In some instances restricted space in the basement has led to the erection of the air pump on the same floor as the main machine. In cases where this pump was driven by a steam turbine, while the condenser and circulating pump erected in the basement had an electric drive, it is probable that the fact was also borne in mind that it would be by no means inexpedient to place the large and small turbine on the same floor in order to secure better supervision. In other respects the space required is approximately the same for both forms of pump drives.

Reliable operation should always be placed before all other considerations. The higher cost at which it must be purchased under certain circumstances may be regarded to some extent as an insurance against the failure of the current supply. The larger the plants are, the greater will the values be which are risked when an incorrect system of drive for the auxiliary machinery is selected.

TESTS ON ROPE DRIVES.

A PAPER read recently describes tests on rope drives under widely varying conditions. Efficiency is highest at the lower speeds, and decreases most rapidly at speeds greater than 4,500 feet per minute. Span between centres has little effect on efficiency until spans greater than 150 feet are used. The American system of driving gives higher capacity and efficiency than the English system when conditions are suitable for its adoption. If care be taken in erection and in jointing of ropes there is no reason why multiple-rope driving should not be as efficient as single-rope driving. The results are plotted in curves, and show for the American open drive an efficiency of 93 per cent. within a wide range; for the English open drive the efficiency decreases linearly from 91 per cent. to 85 per cent. as the speed increases from 2,300 feet per minute to 5,600 feet per minute. The English open drive appears, according to the paper, to be unsuitable for spans of more than 100 ft. because the upper slack part sinks down and may rub on the ground.

The Smart-Turner Machine Co., Ltd., Hamilton, Ont., report having recently secured the following orders:—The National Builders' Supply & Concrete Brick Co., Mascouche Station, Que., duplex pump; E. D. Smith & Son, Winona Ont., duplex pump; Hamilton Bridge Works Co., Hamilton, duplex power pump; the St. Lawrence Paper Mills, Thorold, Ont., centrifugal pump; W. A. Freeman Co., Hamilton, duplex pump; the Gananoque Electric Light & Water Supply Co., Gananoque, Ont., centrifugal pump; the Lotbiniere & Megantic Railway Co., Lyster, Que., duplex pump; the London Cold Storage & Warehouse Co., London, Ont., duplex pump.

Steam and Hydro-Electric Power Plants at Kamloops, B.C.

By W. Large

The accompanying text and illustrations serve to show that Western municipalities are fully alive to the requirements of industries seeking location, in the matter of power, light and water for manufacturing purposes, and that, they, in addition, recognize the all-important consideration, of providing an equipment, both tried and up-to-date.

KAMLOOPS opened its new power house on October 28, with everything in excellent shape. The Royal Commission on Indian Affairs who were in the city paying a visit of inspection, were present in addition to many prominent citizens.

It was found last year that Kamloops could not do any longer with its old power house, which had become too small to carry on the increasing demands for water and light, and arrangements were made to erect an entirely new building with all modern machinery. It had also been planned some time ago to bring power from the Barriere River, 40 miles up the North Thompson, where 10,000 horse power was available, if harnessed, and arrangements have been made to use 2,000 horse power to commence with, and to increase the amount as the city's demands may call for later. Bonds to the amount of $460,000 were therefore issued. $200,000 of which was needed for the power house just completed, and $260,000 for the Barriere Rivere development. At present, some 2,400 horse power is generated at the new station.

The main building is of reinforced concrete and thoroughly fireproof throughout. It consists of two bays; one containing the boilers being 40 ft. x 75 ft., and the other, containing the turbines, pumps and other machinery being 50 ft. x 75. ft. The basement of the turbine bay is on the same level as the boiler room floor and contains the auxiliary apparatus, condensers, transformers and air pumps, besides providing storage for operating supplies. The stack is of concrete, and is 78 inches diameter at the bottom ,by 175 feet high above ground level.. The equipment of the station is as follows:—

Four Babcock & Wilcox boilers of 250 h.p. each and working at 160 lbs. pressure.

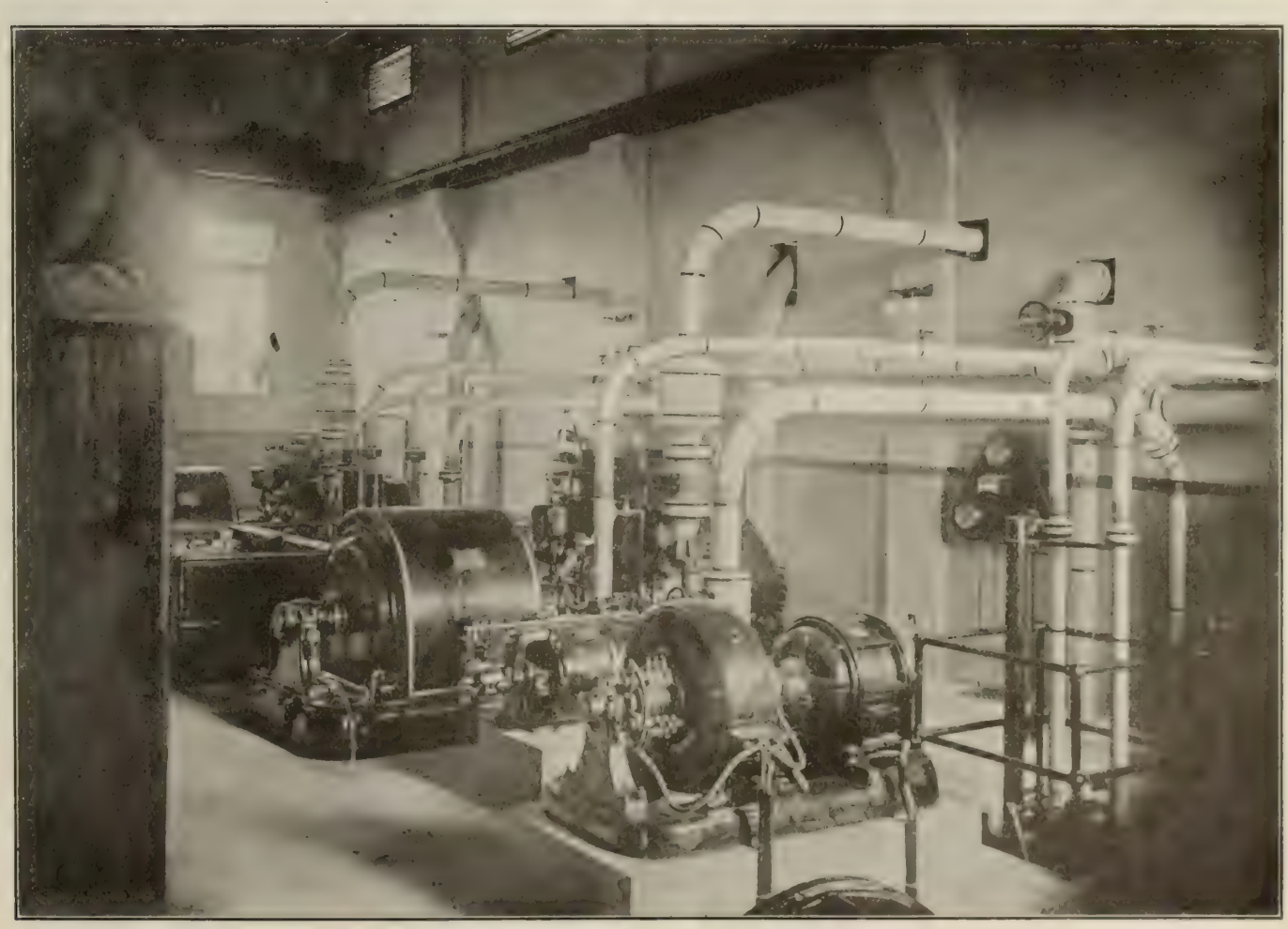
Two boiler feed pumps by the Platt Ironworks, Dayton, Ohio, and a Ford heater.

Two Curtis turbo-alternators of 600 k.w. capacity, 2,200 bolts, three-phase, 60 cycles, operating at 3,600 revolutions per minute. These were supplied by the Canadian General Electric Co., and have forced lubricated, water cooled bearings, electric speed changing device and an over speed safety trip. The turbines exhaust into two Wheeler cylindrical surface condensers, which are equipped with turbine driven circulating pumps. The condensers indicate continuously from 27 to 28 inches of vacuum.

One 15 k.w. turbine driven exciter running at 4,500 revolutions per minute.

One 20 k.w. motor driven exciter running at 1,200 revolutions per minute.

The switchboard is of natural slate and consists of 21 panels for the different services. All high voltage wiring, oil switches and other apparatus, which



GENERAL VIEW OF INTERIOR OF TURBINE ROOM.

would prove dangerous to the operators, are located on a structure some distance to the rear of the switchboard. There is nothing on the switchboard at a potential above 110 volts. An approved type of voltage regulator maintains constant voltage regardless of load variation.

No outgoing power or light lines can be seen at the station, as the conduits run underground through a tunnel under the main line of the C.P.R. to a distributing tower immediately across the track. Beneath the distributing tower is a small substation containing the transformers for a 12,000 volt line to the Iron Mask mine, about eight miles from the city.

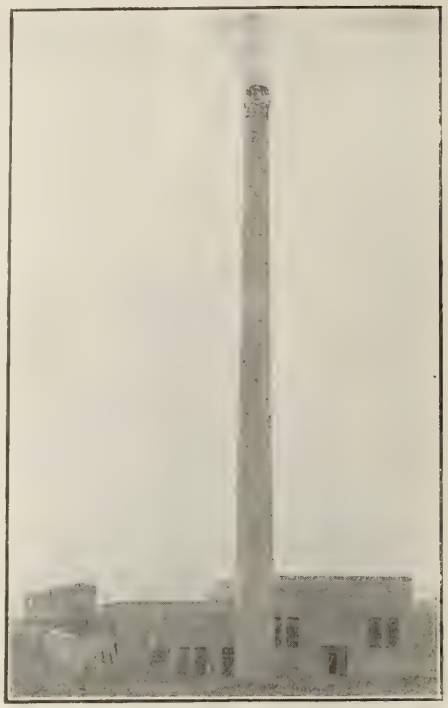
Water Works Section.

The waterworks section of the plant consists of the following:—

Two induction motor driven Platt pumps working at 1,800 revolutions per minute, and delivering 1,200 gallons per minute.

One Kerr turbine driven pump of the same capacity, the turbine exhausting into a Wheeler waterworks type condenser with Edwards air pump. These three pumps discharge through a Simplex Venturi meter with indicating curve drawing and integrating apparatus to register the water pumped into the city mains.

Directly underneath the pumps is a



EXTERIOR OF POWER HOUSE.

16,000 gallon suction tank, which is kept supplied by two vertical motor driven pumps, located in an auxiliary pump house on the bank of the South Thompson river. Both pumps in the auxiliary pump house are operated from the switchboard, one by a standard hand operated started and the other by an automatic starter controlled by a float switch. These pumps discharge 1,500 gallons per minute through a 16-inch steel main into the suction tank. From the power house, the main pumps deliver through a 16-inch steel main to a 1,500,000 gallon reservoir, built last year.

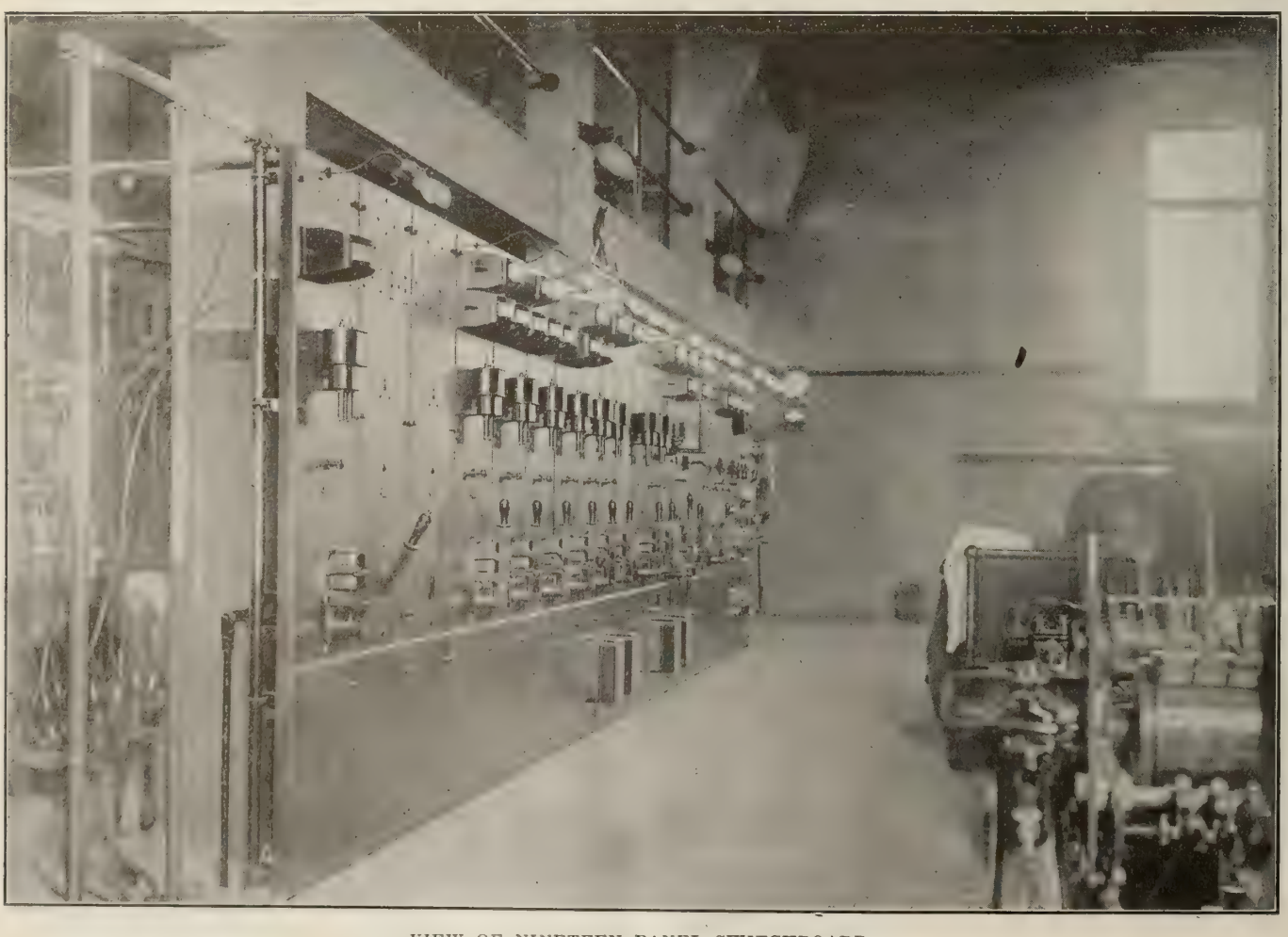
The turbine bay and pump room are served by a 10-ton hand operated travelling crane.

Ashes from the boiler room are handled by a motor driven endless chain conveyer from a hopper on the boiler room level to a distance of 40 feet from the boiler room.

Coal is dumped from an overhead spur into bunkers, from which it gravitates into the boiler room through chutes in the rear wall.

The Barriere Plant.

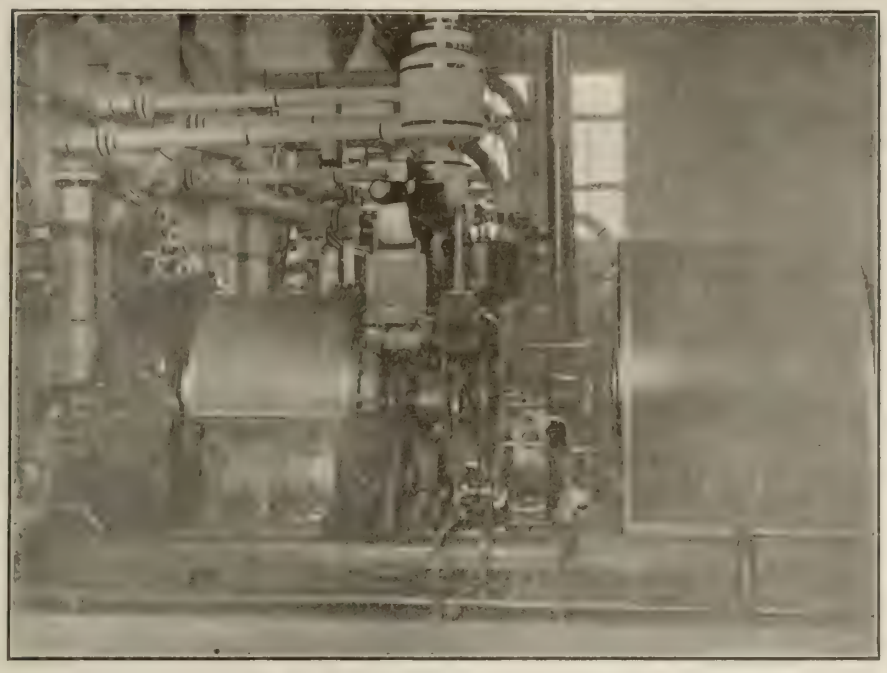
In connection with the equipment of the Barriere plant, the local station will



VIEW OF NINETEEN PANEL SWITCHBOARD.

be utilized with the exception of the turbines and boilers, the turbines being arranged to run in parallel with or to replace the hydro-electric machines in the event of interruption .

The Chas. C. Moore Co., had the contract for supply and installing the equipment, while the building was erected by the local firm of Johnston & Co. The stack was erected by the Weber Chimney Co., of Chicago.



600 K. W. CURTIS TURBO-GENERATOR.

The entire design and construction was carried on under the supervision of Ducane, Dutcher & Co., consulting engineers.

PROFIT SHARING AMONG EMPLOYEES.

THE proposal by a New York mercantile house for participation financially by its employes in the operations of the house, and a further step in this direction by the Youngstown Sheet & Tube Co., both announced within the last few days mark the latest adoptions by large companies of this practice which has become so general among industrial corporations in the past decade.

The United States Steel Corporation was a pioneer among the prominent industrials to initiate profit-sharing on a wide scale for its employes. The finance committee of the company selected the method of stock-subscription in 1902, and allowed its 55,000 (at that time) employes to acquire preferred stock at a price somewhat under the current quotations. Beginning with 1909, and in following years, the common stock of the corporation has been very successful.

Seeking Continuous Service.

The International Harvester Co., the Republic Iron & Steel Co., the United States Rubber Co., the National Biscuit Co., and the E. I. du Pont de Nemours Powder Co., are among the big concerns which have put in force plans more or less resembling that of the Steel Corporation.

In several cases, in order to induce employes to continue as shareholders in the company after they have subscribed, extra payments have been made annually if the holders have been continuous employes of the company and have given satisfactory service. For example, in the 1911 offering to United States Steel Corporation employes, when the preferred stock was sold at $114 and the common at $70, it was provided that on exhibiting a certificate that he had "been continuously in the employ of the corporation and had shown a proper interest in its welfare and progress," the stock-holding employes would receive a payment of $5 per annum per share of preferred and $3.50 per share of common. With similar restrictions the International Harvester Co. allowed a special payment of $4 per share of preferred and $3 per share of common.

Pensions and Bonuses.

Among the companies which have established comprehensive pension and accident policies, including voluntary and permanent disability reliefs, are the International Harvester Co., Youngstown Sheet & Tube, du Pont de Nemours Powder Co., American Sugar, Consolidated Gas, Philadelphia Rapid Transit, and Brooklyn Union Gas. In many cases bonuses have been given employes, the bonus taking various forms, from an outright lump sum as Eastman Kodak distributed, to a graduated percentage of salary after certain years service as was put in force by Sears-Roebuck.

The distribution of large cash bonuses in lump sums has been found impracticable by the Youngstown Sheet & Tube Co., and other companies whose labor is in large part foreign, as it has been the case in the past that numbers of the employes returned to their native countries on receipt of their share.

Many of the railroad companies have comprehensive pension plans in force, and, in years past, several have attempted stock distribution schemes, but with little success, on account of the comparatively low income yield of the securities.

Mr. W. C. Gordon has been appointed Transportation Engineer for the Canadian General Electric Co., and will take charge of all inquiries in connection with electric traction. He has wide experience in connection with not only city and interurban electric traction, but also trunk line electrification. After graduating from Cornell in electrical engineering in 1899 he entered the testing department of the General Electric Co. at Schenectady. While in the railway construction department, he had charge for the General Electric Co. of the installation of the first electrically operated train on Manhattan, Elevated, New York, and later of the installation of the first multiple unit equipments for the Northerwestern Elevated Chicago, Aurora, Elgin and Chicago Ry. Lake Shore Electric Railway, etc., etc. Later, while in the railway engineering department at Schenectady he was closely associated with the further development of multiple unit operation for the New York Central lines and the Interboro Rapid Transit Co. He went to Australia in the General Electric Co. railway interests, and was manager and engineer of the North Melbourne Tramways and Lighting Co., later being engineer for the National Electrical & Engineering Co., handling the New Zealand business for the General Electric Co., and finally being engineering for the Brisbane Tramways Co., until his return to Canada. He is a son of Rev. D. M. Gordon, Principal of Queen's University, Kingston.

The British Manufactuers' Association, Ltd., of London, Eng., have opened offices at 803 McGill Building, Montreal, as agents for the following firms: National Gas Engine Co., makers of all types of gas engines, both horizontal and vertical; Daniel Adamson & Co., makers of Rateau turbines, blowers, pumps, etc.; Geo. Shipman & Co., Sheffield, makers of tool steel, etc.; Adams & Co., makers of cotton waste; and Rockdale Asbestos Co., Ltd., makers of asbestos and hydraulic packings. Roderick J. McLean is the manager.

ELECTRICITY AND HYDRAULICS

This department is intended, in addition to individual treatment, to feature the close relationship existing between electricity and hydraulics in the power and light field.

CENTRIFUGAL PUMPS.

MR. A. TEMPLE ETHORNE, B.Sc., in the course of a lecture on Centrifugal Pumps, delivered before the Graduate Section of the North-East Coast Institution of Engineers and Shipbuilders, remarked that a writer on centrifugal pumps had said that they defied the mathematician and possessed more tricks than a circus mule. With that, most engineers were, until comparatively recently, content to agree, but, with the extraordinary development of turbine machinery generally during the last ten years, centrifugal pumps had now come into very general use.

The centrifugal pump was a water turbine reversed, and, while the water turbine was long ago brought to a high state of efficiency, there was one great difficulty in the reversal of its working process which accounted for the slow development of the centrifugal pump. In the water turbine, the pressure energy of the water supply was converted into kinetic energy on entering the turbine, and that change could be performed in converging nozzles with very little loss. It was the efficient reversal of that process which was the stumbling block.

The Kinetic Energy Problem.

In the centrifugal pump, the water was whisked round in the impeller, and finally was shot out with a high velocity. The absolute velocity of water leaving the impeller might be 50 feet per second or even more, while that in the discharge would rarely be more than 10 feet. Thus, there was a very great amount of kinetic energy in the water as it left the impeller, and, with the reduction of the velocity, the excess of kinetic energy must be converted into pressure energy.

The condition for a reduction without loss was that it must be performed without any abrupt change in either magnitude or direction. In the early pumps the impeller was surrounded by a circular or spiral casing of such dimensions that the velocity of the water round the easing was approximately that of the discharge.. The water was shot out of the impeller, and practically the whole of the surplus kinetic energy was dissipated in shock and eddies due to the impact with the slow-moving mass of water in the casing.

Introduction of the Diffusion Ring.

The first method of preventing that loss was the introduction of a diffusion ring which formed part of the casing and had a gradually increasing cross section, in which the action was approximately that of a fire vortex. That effected a fairly efficient reduction of the velocity, but there was still a considerable loss due to eddies. Guide vanes were next introduced. These were fixed vanes in the diffusion ring which diverted the water into the proper direction for the discharge, and maintained a steady flow through the casing. It was the adoption of guide vanes which had rendered possible the high efficiencies now obtained with centrifugal pumps.

Impeller Blades and Guide Vanes.

The principles governing the shape of the impeller blades and guide vanes were next reviewed. The former, he said, must be such that the water entered and left them without shock. Thus, the entrance and exit angles were determined by the direction of the entrance and exit water velocities under the particular conditions for which the pump was designed. Various considerations with reference to the constructon of these pumps were analysed at considerable length.

Pumping Installation Motive Power.

The choice of motive power for any pumping installation largely depended on local conditions and on whether the pump was to run continuously or intermittently only. For intermittent running, steam power was not efficient and electric motors or oil engines should be employed—the latter being particularly useful when a self-contained plant was required and no steam or electric supply was available—as for instance, on temporary works. The majority of permanent installations were electrically driven, that being the most efficient method when electricity was cheap and readily accessible.

There was, at one time, a prejudice against using electric motors for pumps operating at varying heads, and it was mentioned in the course of the paper that, if the head against which the pump was operating was decreased, the quantity of water was largely increased, and, if the speed remained constant, the power required became excessive. A steam engine was, of course, more easily able to cope with that overload, but the objection to the use of the electric motor no longer held good if the pump impeller was designed so as to give a maximum overload of 25 per cent. and a motor capable of doing that was provided.

Oil engine driven pumps were now being employed for permanent installations, notably at the Gladstone Dock, Liverpool. For boiler feed pumps, circulating and air pumps working in conjunction with a steam plant, it was usually preferable to use steam turbines or high speed steam reciprocating engines.

Centrifugal Pump Services.

As to their uses, they were particularly suitable for dealing with large quantities of water at low heads, and thus were extensively used for drainage and irrigation work. The irrigation of the Nile Valley was performed by a large number of centrifugal pumping installations, and similar work on a large scale had been carried out in the United States. These pumps were usually single-stage horizontal type, and efficiencies of over 60 per cent. had been obtained with pumps of 60 inches diameter, the discharge pipes relieving over 100,000 gallons per minute.

Pumping Solid Matter.

A very important characteristic of the centrifugal pump was its ability to deal with a very considerable quantity of solid matter suspended in the water pumped. Special dredging pumps of very heavy construction had been made which were capable of dealing with stones up to 12 inches in diameter. That had led to a very efficient method of excavating and of dredging from rivers, etc. For excavation, very powerful jets of water were played on the earth, the resulting mixture of earth, stones, and water being collected and pumped by a centrifugal unit.

This method was adopted with great success on the Panama Canal. Four pumps were in use, each capable of deal-

ing with about 150 tons of solid matter per hour, and requiring 10,000 gallons of water per minute. An efficiency of 60 per cent. was attained. The diameter of the discharge was 20 inches, and each pump was driven by a 655-horse power motor.

A different class of work was the pumping of mines. There large quantities of water had to be raised to a very great height, the pumping head often being 1,500 to 2,000 feet. These pumps were, of course, multi-stage type, the allowable head per stage varying from 150 to 200 feet.

Dock Pumping.

Another large field for centrifugal pumps was the pumping of graving docks. This is a rather exceptional service, in that there was a great variation in head during the pumping, and that a rapid emptying of the dock was of greater importance than a high efficiency. The pump was usually designed for the average head, and must have a comparatively small change of capacity over the necessary range of heads, while at the same time the horse-power should remain approximately constant to avoid overloading the motor.

Double entrance impellers were of considerable advantage in dock pumps, and in all pumps dealing with large quantities of water at low heads. In all such pumps, the speed of water through the impeller was high, and consequently the friction head was large. A double entrance impeller considerably reduced the velocity in the impeller with an appreciable gain in efficiency.

Steam turbine-driven pumps were now largely used for boiler feed work and as circulating pumps, the great difficulty here being that the turbine speed was in general considerably above the pump speed. It had been found, however, that a compromise could be arrived at with very little loss of efficiency.

Another very large field for centrifugal pumps was that of a fire station service—the reliability of the installation being a great asset. The building of such pumps was somewhat specialized, the question having been taken up by insurance companies, and fire station pumps were now built to the underwriters' specifications.

The lecture was profusely and excellently illustrated by lantern slides of diagrams and illustrations. The latter included an illustration of one of two 48 in. direct coupled pumping engines for emptying the Trafalgar Dock at Southampton. This pump is capable of delivering, on an average, 200 tons of water per minute, and is direct coupled to a double-pressure condensing engine.

Another slide showed a 42 in. sand pump—one of the four pumps supplied to the big suction dredger Leviathan, owned by the Mersey Docks and Harbor Board, and at present engaged in dredging the bar of the Mersey. The four pumps together are capable of delivering 10,000 tons of sand per hour, drawing the same from the depth of 70 feet and delivering it into the hoppers of the dredger. These pumps are specially constructed for dealing with sand, and all wearing parts are made of special materials. Where serious wear is likely to take place, the parts are so arranged as to be easily renewable.

A third slide showed a 29 in. Invincible centrifugal direct-acting circulating engine, circulating water through the main condensors of one of the British battleships. The pump casing and disc are completely of gun-metal, and the engine of the single-cylinder enclosed forced lubrication type. The set is capable of delivering 2,500 gallons of water per minute against heads up to 30 feet running at 280 revolutions per minute.

EXTINGUISHING FIRES IN OILS AND VOLATILE LIQUIDS.*

Edw. A. Barrier.

THE extinguishing of fires in oils and in most of the volatile liquids has always been a difficult problem, and where fires of this kind occur, the results are frequently very disastrous. Our most common extinguishing agent, water, works rather unsatisfactorily upon the majority of such fires, but it is still the only one available where heroic measures are required. Comparatively recently, however, there have been two or three other materials introduced for use as extinguishers which have shown some promise for dealing with these fires, and it is the purpose of this paper to discuss these materials and the conditions under which they prove the most efficient.

Not all fires in volatile liquids are difficult to handle with water. When the liquid is miscible with water, this extinguishing agent can be successfully used. Examples of this kind are denatured alcohol, wood alcohol, grain alcohol, acetone, etc. Where the liquid is not miscible with water, little or no effect is produced except to wash the burning liquid out of the building where it may be completely consumed, or, if the quantity of oil is small, possibly to extinguish the fire by the brute cooling effect of a large quantity of water sprayed upon the fire. Soda and acid extinguishers are somewhat more effective than pure water, but even they fail under most conditions. The various grenades containing salt solutions which were formerly extensively exploited are, of course, practically worthless.

*From a paper read recently before the American Society of Mechanical Engineers.

The only principles that can be made use of in extinguishing fires in volatile oils are:—(a) To form a blanket either of gas or of solid material over the burning liquid which will exclude the oxygen of the air; or, (b)—To dilute the burning liquid with a non-inflammable extinguishing agent which is miscible with it.

Sawdust and Bicarbonate of Soda.

To the blanketing type of extinguishers belongs sawdust. Paradoxical as it may seem, ordinary sawdust is an excellent extinguishing agent for certain volatile liquids, especially those of a viscous nature. A considerable number of experiments were conducted in the fall of 1912 by the inspection department of the Associated Factory Mutual Fire Insurance Companies, in the extinguishing of fires in lacquer and gasoline in tanks with sawdust, and the results were surprisingly satisfactory.

The liquids were placed in three tanks 30 in. long, 12 in. wide and 16 in. deep; 48 in. long, 14 in. wide and 16 in. deep; and 60 in. long, 30 in. wide and 16 in. deep. The sawdust was applied with a long-handled, light but substantially built snow shovel, having a blade of considerable area. In every case the fires were extinguished readily, especially in the two smaller tanks, which were about as large as any ordinarily employed for lacquer in manufacturing establishments.

The efficiency of the sawdust is undoubtedly due to its blanketing action in floating for a time upon the surface of the liquid and excluding the oxygen of the air. Its efficiency is greater on viscous liquids than on thin liquids, since it floats more readily on the former than on the latter. The sawdust itself is not easily ignited and when it does become ignited it burns without flame. The burning embers have not a sufficiently high temperature to reignite the liquid.

The character of the sawdust, whether from soft wood or hard wood, appears to be of little or no importance, and the amount of moisture contained in it is apparently not a factor, so that the drying out of sawdust when kept in manufacturing establishments for a time would not effect the efficiency.

It was found that the admixture of sodium bicarbonate greatly increased the efficiency of the sawdust, as shown both by the shortened time and the decreased amount of material necessary to extinguish the fires. A further advantage of the addition of bicarbonate of soda is that it decreases the possible danger resulting from the presence of sawdust in manufacturing plants, since it would be difficult, if not impossible, to ignite the mixture by a carelessly thrown

match or any other ready source of ignition.

Although the efficiency of the sawdust is greatest on viscous liquids such as lacquers, heavy oils, Japan, waxes, etc., in the tests referred to, fires were extinguished in gasoline contained in the smallest tank and also when spread upon the ground. In larger tanks, the sawdust or bicarbonate mixture does not work so well since the sawdust sinks before the whole surface can be covered, whereupon the exposed liquid reignites.

Carbon Tetrachloride.

In recent years carbon tetrachloride has received considerable attention as a fire-extinguishing agent. This is due largely to the activity of certain manufacturers of fire extinguishers which use liquids, the basis of which is carbon tetrachloride. This substance is a water white liquid and possesses when pure a rather agreeable odor somewhat similar to chloroform. A considerable proportion of the commercial article upon the market, however, contains sulphur impurities which impart a disagreeable odor to the liquid. The substance is quite heavy, its specific gravity being 1,632 at 32 deg. fahr. It is non-inflammable, non-explosive, and is readily miscible with oils, waxes, japan, etc. When mixed with inflammable liquids it renders them non-inflammable provided a sufficient quantity is added. Its vapor is heavy, the specific gravity being about five and one-half times that of air, consequently it settles very rapidly. As an extinguishing agent, it dilutes the inflammable liquid rendering it non-inflammable, or at least less inflammable, and it forms a blanket of gas or vapor over the burning liquid which excludes the oxygen of the air.

Although this paper is confined to a discussion of extinguishing fires in oils and volatile liquids, it may not be out of place to mention that the claims made by certain manufacturers producing extinguishers which use liquids, the basis of which is carbon tetrachloride, are grossly exaggerated. These preparations none of which is more efficient than carbon tetrachloride, are not the equivalent of the ordinary water extinguishers for general use on such materials as cotton, wood, paper, oily waste, etc.

On volatile liquids, oils, etc., carbon tetrachloride has, however, shown very satisfactory results under some conditions, but the readiness with which a fire can be extinguished with it depends to a considerable extent upon the skill of the operator and the nature of the fire. In tank fires the length of time that the liquid has been burning is an important factor, and in such cases where the sides of the tank become heated the only way in which the fire can be extinguished is to squirt the liquid forcibly at the sides. If the carbon tetrachloride is squirted directly into the liquid it is much more difficult, if not impossible, to extinguish the fire.

The height of the liquid in the tank is also a very important factor. Where the liquid is low the sides form a pocket which retains the vapor and aids considerably in smothering the blaze. When the tank is nearly full, however, this condition does not exist, and it is then very difficult, if not impossible, to extinguish a fire in a highly volatile liquid, such as gasoline; only the most skilled operators are successful in these cases. The size of the tank or the extent of the fire if upon the floor is, as would be expected, of considerable importance. In tanks larger than about 28 in. by 12 in. more than one extinguisher and operator working at a time are necessary to extinguish a fire in such materials as gasoline. In one test where a tank 60 in. by 30 in. was used no less than seven operators were necessary, and even then it was only with the greatest difficulty that the fire was put out.

All of the above remarks apply to carbon tetrachloride in the ordinary one-quart extinguisher as generally sold. It is probable that a large extinguisher which could throw a large stream would prove more efficient, but on account of the great weight of carbon tetrachloride such an extinguisher would have to be specially designed to make it readily portable by mounting on a truck or some similar means. Expelling the liquid by means of a hand-pumping arrangement would probably be unsatisfactory, and it would therefore be necessary to force it out in some other way.

A few systems have recently been installed in which an elevated tank containing carbon tetrachloride was connected with automatic sprinklers or perforated pipes located in hazardous rooms where volatile and inflammable liquids are in use. So far as is known none of these systems have as yet been called upon to extinguish a fire, but there appears to be no reason why such a system should not provide excellent protection in special cases. In such systems it would be necessary to consider the safety of the workmen and furnish ready means of escape, since carbon tetrachloride is an anesthetic and where thoroughly sprayed through the air as from an automatic sprinkler it would probably produce rapid results.

The Fumes Feature.

The nature and effect of the fumes given off when carbon tetrachloride is thrown upon a fire is a subject which has received a great deal of discussion. When the liquid comes in contact with a fire the vapor is partly decomposed resulting in the evolution of a considerable quantity of black smoke which is undoubtedly finely divided carbon. Pungent gases are also produced which appear to be mostly hydrochloric acid with possibly a small amount of chlorine. Since carbon tetrachloride contains no hydrogen from which hydrochloric acid could be formed this substance must be produced by the action of chlorine on the gases arising from the burning material or upon the moisture of the air.

The fumes of carbon tetrachloride although of a very pungent nature do not produce any permanent injury under ordinary conditions where the operator can make his escape after he has inhaled all that he can stand, but they are a distinct handicap in fighting a fire and are one of the objectionable features to carbon tetrachloride as a general fire extinguishing agent. In large rooms or where a small quantity of carbon tetrachloride is sufficient to extinguish a fire the gases are, of course, less objectionable.

Frothy Mixtures.

Another method of extinguishing fires in oils and volatile liquids which has recently been proposed and experimented with is that of using frothy mixtures. The idea seems like a very promising one and the tests which have been thus far reported indicate very satisfactory results. The idea was originated and has been developed in Germany. So far as is known no experiments have been conducted in this country.

The process consists essentially in causing two liquids to mix in a tank where foam is produced. The tank is made air-tight and sufficiently strong to permit of the foam being forced out by carbon dioxide under pressure, and the foam is conveyed to the fire by means of a line of hose. The exact nature of the liquids has not been disclosed, but one of them probably consists of a sodium carbonate solution containing froth-forming ingredients such as glue or casein and the other an alum solution. The two on coming together generate carbon dioxide which produces froth. This froth is reported to be quite stiff and to shrink in volume but a comparatively small amount even after a period of half an hour.

The frothy mixture undoubtedly owes its efficiency to its blanketing action in settling upon the surface of the burning liquid, thus excluding the oxygen of the air, and to the fact that the bubbles of liquid contain carbon dioxide which upon bursting produce an atmosphere in which combustion cannot take place.

REFRIGERATION DEPARTMENT

ELECTRICALLY DRIVEN ICE PLANTS.*

By C. H. Stevens, Brooklyn, N.Y.

IN the past few years there have been many marked developments in the science of making artificial ice. Perhaps the two most important have been the successful development and operation of plants making ice from raw water, and the economical operation of these plants by electricity as supplied by the central stations. This paper dwells upon the latter development, its object being to treat upon the past and present relationship between the central stations and the manufacturers of ice, and to present some data on the principle of central station rates as applying to this business.

At the present time there are in the United States at least fifteen artificial ice plants of over 90 tons capacity which are operating exclusively on central station service and probably as many more refrigeration plants of the same or larger capacity. When we consider that this marked development has been made within a comparatively short time and that all of these plants have proven entirely successful, both from the standpoints of efficiency and economy, we must be impressed by the fact that electricity as supplied from central stations and applied to the ice-making and refrigeration business has a vital bearing upon that industry at the present time, and is to play a still more important part in its future development.

Ice Manufacture a Dual Enterprise.

Previous to this development, a manufacturer of artificial ice was really engaged in two enterprises. First, the manufacture and sale of ice, and second, the operation of the power plant. This statement may be made with impunity as applying to this particular kind of business, as there are conditions which are peculiar to this industry which would not apply to the ordinary industrial concern. For instance, the power item in manufacturing concerns such as shoe factories, silk mills, clothing manufacturers, etc., is a minor consideration as compared with the other component parts which go to make up the total cost of the finished product. In some lines of business such as those mentioned, the cost of power may not form more than 1 per cent. of the total manufacturing cost, therefore, this manufacturer may not give any great amount of attention to the operation of his power plant, but instead, devotes his time and energy to the more important items affecting his costs.

Prominence of the Power Feature.

In the manufacture of ice, however, there is a decidedly different situation, for in this enterprise it is not at all uncommon for the power cost alone to constitute over 50 per cent. of the total cost of the manufactured product, and as the other items which go to make up the total cost are several and of lesser importance, it is easily discernible that the power problem is the all important feature on which depends the economical production of artificial ice. This item is necessarily a variable, as it depends entirely upon the maintenance of certain efficiencies of the engines and boilers, and the market price of fuel, labor and of engine room supplies. Naturally a very small increase or decrease in the evaporation of the boilers, the performance of the engines, or the market price of coal will materially affect the balance sheet of that particular plant at the end of the year.

It is obvious then that the successful ice manufacturer up to the period mentioned, must of necessity have spent the greater part of his time and efforts on operating a power plant. This being so, it is logical to suppose that he could not give the same time and consideration to the part of his industry which dealt with its actual development and extension, and which he otherwise would properly have devoted to it. It is not meant by this statement that the business as a whole was not successful, but the inference is that there would have been greater possibilities if this power plant operation had not been such an important factor.

Minimizing the Power Plant Attention.

If there could have been a means devised whereby this responsibility of power plant operation could have been placed upon the shoulders of someone else by purchasing the power from an outside source it would have been an ideal condition. However, the ice manufacturer at this time did not consider that such a situation existed. He knew that many industrial concerns had discarded their private plants, and were purchasing their power from the central station companies, but he considered that a direct comparison could not be made between their power requirements and his own, inasmuch as he was operating 24 hours per day at an exceptionally steady load and thereby getting the higher efficiencies out of his engine and boiler equipments. Furthermore, he was making ice from distilled water and was obtaining this distillate from the exhaust of his engines. With this situation before him, he did not go to the central stations for quotations on power, and the central stations—not being thoroughly conversant with the ice business—did not with any degree of earnestness solicit this business from him.

Later, several manufacturers found that they could eliminate the handicap of exhaust steam for distilling purposes to a remarkable degree by the installation of multiple effect evaporators by which as high as 50 tons of distilled water were obtained per ton of coal fired. However, another and most important development occurred, which practically eliminated the distilled water question altogether. It was the advent of the raw water system of making ice. With the successful operation of this type of plant, distilled water is only used to re-fill the core, and in some of the most modern systems in use to-day even this feature has been entirely eliminated and the entire cake of ice is being made from raw water.

With this question of exhaust steam for distilling purposes removed from both types of plants, the manufacturer was placed in a position where he could get a greater fuel economy out of his plants by installing condensing engines on his compressors, or where he could still further increase the over-all efficiency and eliminate the responsibility of a power plant by purchasing his power directly from a central station company, provided of course, that he could get an advantageous rate.

There probably is not an ice manufacturer but who, if he gives the matter serious thought, would rather have his ice plant operated by electric motors, and the current supplied from an outside source, if he could do so with economy over any other method of opera-

*From a paper read at the Seventh Annual Meeting of the Eastern Ice Association in New York, November, 1913.

tion. The average manufacturer of today, whether he be in the ice business or some other line, realizes the relative value of central station service over other means of making power, and as to whether or not he will install it in his premises is purely a matter of dollars and cents at the end of the year. This brings it down simply to a question as to whether a central station company can sell current at a rate sufficiently low to secure the ice business.

Central Station Power Rates.

It is doubtful if there is any fair-minded engineer who will admit that a central station company is in a position to manufacture a certain amount of current at its generating station for a less cost per kilowatt hour than that same amount of current can be manufactured by any individual or concern within their own premises. Such a condition, of course, is occasioned by reduced fuel, labor, and supplies cost, and the higher efficiency units of which they may take advantage. However, there may be an argument advanced by some engineers to the effect that while the central station company can generate the actual amount of current used by an ice plant cheaper than it can be obtained by engines on the premises, they must in their system of charging take into consideration a very large peak load which occurs on their stations in the Fall of the year and has a certain effect on their yearly generating costs. In anticipation of such an argument, the following explanation is given:

Large Peak Load Feature.

This peak load does as a rule occur during the winter months, and is caused by the day load on the stations or power load overlapping the night load, or lighting load. This peak on most stations occurs during the months of November, December, January and February, between the hours of 4 and 9 o'clock p.m. To take care of this peak load a large amount of generating apparatus must be kept in the stations which may not be used during the rest of the year, and the fixed charges on this extra equipment have a slight bearing on the total generating costs for the year, of such current as is used during this peak period.

While this condition does exist, the bearing which it has upon the total generating costs is so small as to be almost negligible and need have no bearing whatsoever upon the rates offered to an ice plant, owing to a condition which is peculiar to this business in relation to this peak load. The condition is that the same hours during the year that the central station has this peak load are the least important of any during the year to the ice plant, as the outside temperatures are sufficiently low to reduce the full 24 hours use of the large compressors. Therefore, if necessary, the ice plant can shut down the large compressors during these hours and can do so without in any way handicapping their business.

It is obvious then that the necessary current to operate an ice plant can be made in a central generating station more cheaply than that same amount of current can be produced on the premises by private means, and that this cost can still further be reduced, if the ice plants shut down their large compressors during the peak period of the winter months. Admitting this, it is then simply a question of the central station companies adding to their generating costs the cost of distributing the current, which in most instances is a very minor consideration, as the service supplied for this work is usually high tension alternating current which can be distributed at a minimum amount of loss, plus a small margin of profit, and quoting that price to the manufacturer.

Central Station Power Successfully Applied.

The matter becomes then purely an economic question as to what such companies are willing to sell current for, as to whether or not it is the proper power for an ice plant to install. The best evidence that several companies have met this issue fairly and adopted rates for this business, which are below what power can be produced for by private means, is the statement made before in this paper, that there are now at least 15 plants of over 90 tons capacity which have been operating long enough on central station service to substantiate the claim made.

This paper is written on behalf of the Edison Electric Illuminating Co., of Brooklyn, which is one of the companies which have such rates in force, at the present time, and is true of the conditions and practices generally in other parts of the country. Some companies may not have up to the present time adopted rates which apply specifically to the ice-making business, however, the conditions exist whereby they can offer such rates, and if they have not already, it may be because they have not had the ice proposition put fairly before them.

Ice manufacturers should realize that this policy, which the central station companies offer applying particularly to their business, is comparatively new and has not up to the present time received a great deal of publicity. They should, therefore, be careful not to make comparisons between what it is costing them to make power, and what the central station companies are selling power for to the average industrial concerns. If they are really interested in using electricity as a motive power they should take the matter up directly with the company in their city, and explain that their requirements of power are for 24 hours' service at practically a steady load, and if necessary they can shut down their large compressors during the peak load on the generating station. These conditions are ideal from the central station standpoint and in every instance should receive special consideration.

Recently an article appeared in one of the trade papers of this industry under the heading, "The Use of Electricity from Central Power Stations for Refrigerating and Ice-making Plants." In this article invidious comparisons were made between the cost of operating private plants in different parts of the country against central station rates as applied only to one company operating in New York City. All such comparisons as these are misleading in the extreme and have no bearing whatsoever upon the title of the article. Each case should be investigated upon its merits alone, and it should be an "ice-making plant operated by private means versus an ice-making plant operated by central station service," and not an "ice-making plant operated by private plant versus a shoe factory operated by central station service."

The load of an ice-making plant is particularly desirable from a central station standpoint, and the ice manufacturer is desirous of reducing his operating costs and being relieved of power plant responsibility. It, therefore, seems to be principally a question of the two industries getting together.

STATIONARY ENGINEERS' CERTIFICATES.

By J. A. H.

TO give readers of the Power House an idea of how simple it is for the examiners to pass out certificates to men with little or no experience in practical work. I know of three men in the same town as myself and employed by one firm who each were granted licenses recently and who previous to receiving the licenses had let a boiler go dry in one case, badly blistered another, and sprung the 52 tubes in a third, so badly that it was possible to insert a rule on its flat between some of the tubes and the plate. I am in intimate touch both with the men and the boilers, and do not hesitate to say that the former could not keep a pump going, much less take charge of boilers of 150 horse power.

Series of Practical Questions and Answers for Engineers

The present series of Questions and Answers will be departmental in their scope, it being our intention during the course of publication to have an equal number appear in each issue relative to two sections of power plant operation and practice. Comment and inquiry is invited.

PIPES AND FITTINGS.

Question.—What is the purpose of a steam separator? Where is it usually placed and what are a few of the considerations regarding it?

Answer.—It is placed on the live steam pipe line close up to the engine with the idea of abstracting water in suspension from the steam before the latter enters the engine cylinder. It should be of sufficient strength to withstand the full steam pressure, and as the surface area exposed is large, it should be covered with suitable non-conducting material to minmize condensation. All separators should be fitted with a water gauge, which in the case of high pressure, should be provided with a protector. The bottom of the separator should be connected with an automatic steam trap. The separator is usually cylindrical in form and consists essentially of a diaphragm extending downwards into the interior, against which the entering steam impinges and rids itself of the water in suspension. The steam then passes under the lower edge of the diaphragm, up to the outlet to the engine on same level as the entering steam, while the water falls to the bottom of the chamber and is drained off by the above mentioned automatic steam trap.

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Question.—Indicate a few considerations relative to the feeding arrangements for steam boilers?

Answer.—Efficient means should be provided for supplying boilers with water. A regular water level should be maintained, and, if practicable, a continuous feed should be adopted. Whether the boiler is fed by a pump or an injector, a feed check valve should be fitted on the boiler, and it is advisable to have the feed valve provided with a screwed spindle, not attached to the valve, by which the lift can be regulated or the valve closed, if required. Care should be taken to prevent valve seats getting out of position, as this may entirely stop the feed supply or allow the admission of steam to the feed pipes and so give rise to water-hammer within them. To prevent the water level of the boiler being lowered to a dangerous extent, through leakage past the feed check valve, due to wear of the bearing surfaces through grit, or to the presence of foreign matter—matches, packing, or bits of wood—between the valve and seating, the feed pipe within the boiler should be so arranged as to discharge about three inches above the level of the furnace crown, firebox, or tubes. To allow easy examination of the check valve, while the boiler is under steam, a cock or valve is sometimes placed between it and the boiler.

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Question.—From what does water-hammer arise and how can it be prevented?

Answer.—Water-hammer arises chiefly from two causes, either from admission of steam into pipes containing water, or from drainage of pipes while under steam in such a way as to present suddenly a large surface of comparatively cold water to the steam. Water-hammer can only be avoided by preventing the accumulation of water in the steam pipes. To prevent priming, a medium water level and steady pressure should be maintained in the boiler, grease and excess of soda should be avoided in the feed water, while an anti-priming pipe fitted within the boiler is a useful adjunct. Much can also be done to reduce condensation by covering the pipes and preventing the escape of steam through leaky valves. The pipes should be laid with a fall to a select point and properly drained at all places where water can lodge; for example, at stop valves on boilers and engines, and in downward bends.

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Question.—What precaution should an attendant take before admitting steam to any pipe?

Answer.—Before admitting steam to any pipe, the attendant should ascertain that it contains no water, either by satisfying himself that the steam trap is working or, if there is no automatic drain, by viewing the end of the drain pipe, and if there is a vacuum within the pipe, sufficient time should be allowed for it to attain atmospheric pressure, before concluding that it is clear of water. The attendant should not attempt to turn on steam so long as he hears the hissing sound of inrushing air. Should the attendant desire to turn on steam expressly to aid the draining, great caution must be exercised.

The only safe way to clear pipes so charged with water is first to shut down the boiler stop valves and drain the water away gradually, the boiler valves being opened to admit only sufficient steam to blow out the water slowly and heat the pipes, after which they may be fully opened without fear.

Question.—What weight should be placed on a safety valve lever, of which the following accessory particulars are given? Length of lever 18 in. from fulcrum to inside of hooked end; distance of fulcrum to valve centre 3 in.; valve diameter 2¾ in.; boiler pressure 100 lbs. per square inch by gauge; upward pressure of steam necessary to lift valve and lever without weight, 20 lbs.

Answer.—The weight required is found by multiplying the boiler gauge pressure and the valve area together; subtracting from the result the upward pressure of steam necessary to lift valve and lever alone; multiplying the remainder by the distance between the valve centre and fulcrum, and dividing by the distance between fulcrum and desired position of weight on lever.

$$\text{Weight} = (100 \times 5.94) - 20, \times \frac{3}{18}$$

$$= (594 - 20, \times \frac{3}{18}$$

$$= \frac{574 \times 3}{18} = 95.66 \text{ pounds.}$$

• • •

Question.—What is the purpose of a reducing valve? Indicate some of the dangers arising from it in service.

Answer.—It is often necessary to reduce the boiler pressure considerably for some special department of a manufacturing enterprise, a laundry or dye works being perhaps typical examples. This is effected by means of a reducing valve, and the principal danger arises from the valve failing to act and allowing high pressure steam to pass to fittings and vessels designed for low pressure only. As a precaution, a pressure gauge and safety valve should be fitted on the low pressure side, while a stop valve should be fitted to the high pressure side so that steam may be shut off if the reducing valve fails to operate properly. This stop valve also allows the reducing valve to be overhauled. The weak part of many reducing valves is the diaphragm. It should be of good quality, sufficiently elastic, and able to stand a high temperature. If superheated steam be used, it should be turned on slowly to ensure the presence of a sufficient quantity of water in the arm above the diaphragm in order to protect it from the action of the steam.

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THE SEASON'S GREETINGS.

THE publishers of this journal extend to its subscribers and advertisers the dual greeting of a Christmastide of Good Cheer, and of a New Year throughout whose course the blessings of good health, of work in plenty and its hearty performance, together with the reward commensurate, will be the special portion of all.

The year now closing has been marked by a sustained recognition of the increasing value of the place and purpose accomplishment of The Power House in the realm of power plant practice in Canada. All of this we appreciate, stimulating, as it does, to greater effort along the lines already undertaken in the matter of their further development, and in the introduction of such new features as the progress of power plant practice makes incumbent that our readers should become early and thoroughly conversant with.

ROTARY ENGINES.

WE had thought that the development of the steam turbine into the front rank of prime movers—call it a rotary engine if you like, would have had a somewhat dampening effect on inventive genius relative to what are distinctively known as rotary engines; in other words, the revolving piston type machine. There has, however, been little let-up, which goes to show what a fascination such a product seems to have for some people.

Like men and machines of a type generally, there is a striking similarity between all the piston type rotaries, but the parallel between the former and the latter develops into divergent lines by pushing it a little further. Valuable time and hundreds of thousands of dollars have been expended in the quest for a piston type machine which will compass the work of the old time, yet modernly designed reciprocating steam engine; and now that a rotary type machine—the steam turbine, has given evidence of its capacity, efficiency, economy, and reliability under the most severe and exacting service conditions, in spite of its complicated structure, and that the best brains of the civilized world in steam and mechanical engineering have failed to connect greater simplicity with reliable service, it only remains for those obsessed by the idea that they have a piston type rotary engine design in their head, which if put into material form would revolutionize the whole realm of prime movers, to lull it to sleep and tuck it away against a day when their work and worth will be less valuable to the engineering profession than it is now.

We had the benefit of an experience extending over about three years with a piston type rotary engine, and although we would not now have missed it, and, while young engineers of to-day may desire to acquire the same experience, for which they are not to be blamed, they should make certain that like the writer, it is not gained at the expense of their own coin. It will matter little, however, if they forego the lust for this particular experience, as opportunity for gaining other and more profitable training with a definite and satisfactory outcome was never more easily grasped than now.

ENGINEERS STUDY COURSES.

THE Ottawa Stationary Steam Engineers affiliated with the C.A.S.E., are to be congratulated on the ambitious programme which they have laid out for themselves during the coming winter. It is abundantly evident that Lodge No. 7, Ottawa, is in good health and spirits, and that its individual members, while none the less competent, compared with their brethren in other localities, are keenly alive to the necessity of meeting for mutually helpful instruction, a circumstance due primarily to the rapid progress and development taking place in the various spheres of power generation.

The decision to throw these class meetings open to engineers generally is a wise one, and indicates not only a true fraternal spirit, but at the same times expresses realization of the fact that the greatest amount of helpfulness will be appropriated by the combination and co-operation of the greatest number of individual experiences. Incidentally, we look for an accession to the membership of the Lodge as a further result.

Ottawa No. 7, C.A.S.E. and a number of others, have, by publicly declaring a practical policy for the upbuilding and betterment of their members, performed a service to every other body of operative engineers in our manufacturing centres, by arousing within them the spirit of emulation, and as it is not by any means too late—it never is, to make a start, we expect to hear that educational engineering instruction courses are under way in the majority of our cities and towns, where power plants, large and small, are to be found.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in the Power Field.

Stellarton, No. 34, C.A.S.E.—The summer season has had an adverse tendency on the growth and development of this branch, but the local secretary reports that there is every indication of an increased membership, a more lively interest in matters pertaining to the welfare of operative engineers, and, as an obvious result, a highly profitable winter season in prospect.

London, No. 30, C.A.S.E.—On Wednesday evening, November 27, a delegation of London stationary engineers, composed of Geo. W. Fowler, John E. Middleton, D. F. Campbell, W. C. Rogers, W. J. Paynter, Richard Warren and W. G. Walters, visited Stratford, No. 31, C.A.S.E. Bro. G. W. Fowler was host at a dinner in the Windsor Hotel, and that he played the part to the fullest extent was the unanimous opinion of all who participated in his hospitality. Following the dinner, adjournment was made to the lodge room of Stratford, No. 31, C.A.S.E., and here the local fraternity were found to have gathered in large numbers. Local Vice-President Jas. Swanson occupied the chair at the meeting in the lodge room. Past Executive President J. A. Robertson, of Stratford, introduced the London delegation, and expressed the pleasure they felt at having their fellow-craftsmen with them. President John E. Middleton, of London, expressed thanks for the heartiness of their welcome, and indicated a desire that such functions might become a regular feature. Addresses on topics relative to the craft of stationary steam engineering were given by D. F. Campbell, J. A. Robertson, Geo. W. Fowler, John Morenz, A. Scrimgeour, W. J. Paynter, Geo. Hird, R. Warren, W. C. Rogers, each of whom proved a capable exponent both in the art of public speaking and in the exposition of his particular subject. The advisability of again making an appeal to the Ontario Legislature on behalf of graded certificates for operative engineers was taken up and fully discussed, and as a result a unanimous decision was arrived at to petition the Provincial Parliament at the coming session. Before leaving, the delegation extended to their Stratford brethren a cordial invitation to a similar function in London, in order, as they expressed it, that the "debt incurred" might be wiped out. There is every indication that London No. 30 is in a flourishing condition, due largely to the enthusiasm of its individual members. The formation of a social club committee, composed of Bros. Paynter, Rogers and Walters, is a step in the right direction, and the gigantic smoker to be held in the near future, the committee chairman for which is lodge Vice-President G. F. Galloway, gives promise of making record for good fellowship. A note of regret was expressed in Stratford that George Moll was not a member of the delegation from London, but banquets, two evenings in succession, are a trifle heavy on men of even less jovial nature and constitutional calibre than George as we know him.

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Must Use Smoke Consumers.

Montreal, like most large manufacturing cities, is troubled with smoke from factories. Mr. O. E. Champagne, city boiler inspector, following a suggestion made by the grand jury, has recommended that a by-law be passed which will make it compulsory for householders as well as factories to use anthracite coal and smoke consumers, instead of soft coal. There is a city by-law already which makes it compulsory for factories and works of all kinds to use smoke consumers, and attention is now being turned to residences and apartment houses. The Board of Control have referred the matter to the legislative committee.

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THE OPERATORS' VIEWPOINT

Devoted to brief descriptive article contributions covering ideas and expenences pertaining to power plant practice and operation. We pay for accepted material.

FILLING OIL TANKS.

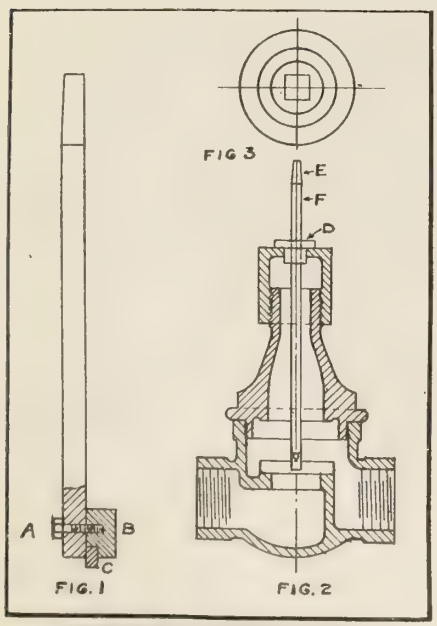
By J. E. McCormack.

WHEN filling 5-gallon oil tanks or cans from barrels stored in a cold place without the aid of an oil pump, the work may be hastened by fixing a nipple and piece of rubber tubing with mouth piece attached to the air vent; thereafter, by blowing through the tube, sufficient air pressure can be obtained in the barrel to greatly accelerate the oil flow. The tubing should be sufficiently light so that by squeezing it between the thumb and fore-finger, the pressure can be held inside the barrel while the operator takes a breathing spell.

A JENKINS VALVE RESEATER.

By J. E. N.

SOME years ago I made a tool to reseat Jenkins style valves, and Figs. 1, 2, and 3, show it. The square iron



JENKINS VALVE RESEATER.

rod (F) can be tapered slightly at the top if required, and for valves up to 2 inches diameter, a ⅜ inch rod is big enough as this size rod will fit nicely into a breast drill. A 3-16 in. or ¼ in. in. bolt (A) holds the clamp (B) in place, and the latter can be made from a piece of iron ⅜ x ½ inch. This clamp holds in place a piece of file (C).

To use the apparatus, remove the bonnet and valve stem, then remove the stem from the bonnet and place the rod and file in its place and screw on the bonnet again. As the stems in different sized valves arre not the same in diameter it will be necessary to get a few small bushings (D), made. By placing the tool as shown and giving it a few turns with a brace or breast drill, a new face will be ground on the valve seat, and if absolute smoothness is desired, remove the file, after turning the new seat, and place a short piece of tool steel in its place. A few turns with this latter on the filed seat will make it absolutely smooth.

It is obvious that different lengths of file and steel will be required for different sized valves. This tool costs only a very small sum of money in any case, to make or even get made, and it will positively make a true and smooth seat on valves from 1¼ inch up to 2½ inch with only a few minutes work. The valve can be repaired without removing it from the pipe, but care should be used to see that all brass filings are washed out before replacing the stem and disc.

REMOVING, REPLACING AND BEADING BOILER TUBES.

By H. Westwood.

IN the November issue of The Power House, J. Langridge wished to know "What is the usual procedure in removing, replacing and beading tubes in a return tubular boiler.

The manner of installing tubes does not differ materially with types of boilers. In removing a full set of tubes from a return tubular boiler, a start should be made from the bottom, being the tubes nearest the hand hole. The tube in the front head is cut off with a bar as shown in Fig. 1 while the bead is cut off the tube in the rear end with a hammer and flat chisel. The tube is thin worked down and out of the hand hole in the front head.

In case one or just a few tubes are to be taken out the front end is usually split and the bead cut off on the back head. Then, by means of a sledge and special tool, the tube is knocked out of the tube sheet and removed. The ripper shown in Fig. 2 is used in splitting the tube, after which a slit is cut, extending back beyond the tube sheet an inch or two. This allows the tube to be closed in and removed through its own hole.

Scale Trouble.

If scale adheres to the tubes to the extent that they cannot readily be removed in this manner then they must be removthrough the hand hole. Should the latter not be in a convenient place, the hole in the tube sheet may be enlarged and the tube extracted through it. For this purpose it is necessary usually to enlarge the hole from ⅛ to 3-16 of an inch, depending upon the amount of scale adhering. It should not, however, be enlarged more than necessary, as it must be reduced to nearly normal size

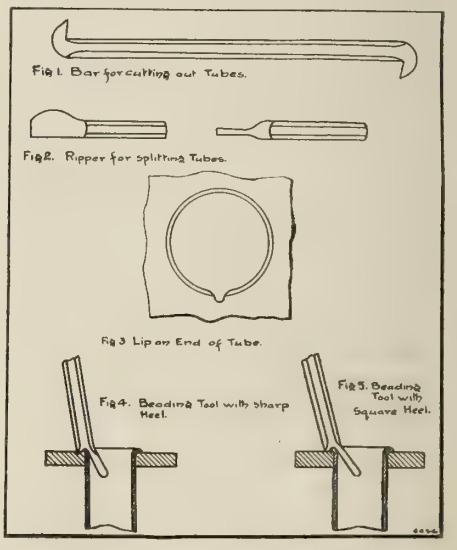


Fig 1. Bar for cutting out Tubes.
Fig 2. Ripper for splitting Tubes.
Fig 3 Lip on End of Tube.
Fig 4. Beading Tool with sharp Heel.
Fig 5. Beading Tool with Square Heel.

REMOVING, REPLACING AND BEADING BOILER TUBES.

when the new tube is put in. In some cases, especially with the locomotive type of boiler a copper ferrule is placed between the tubes and the sheets. This however, usually applies only to the sheets directly in contact with the flames and hot gases, although some manufac-

turers use a copper ferrule in both tube sheets.

The replacing of tubes in an old tube sheet must be done with the utmost care. The sheets should be carefully inspected and all scale removed from the inside surface around the hole. The edges of the holes should be chamfered leaving a good fillet to prevent the tube from being cut by sharp edges or burrs. Again, the holes are liable to be out of round, in which case they must be reamed.

In some types of boilers there is a marked tendency for the fire box sheets to expand more in a vertical than in a horizontal direction. This distorts the hole, the vertical diameter being slightly greater than the horizontal diameter. The holes at the centre of the tube sheet usually suffer most from this distortion.

Installing a Set of Tubes.

Before installing a set of tubes, attention should be given to the sheets to see if they are straight, and if not they should be straightened as far as possible. This is accomplished by means of bars and bolts. When the sheet has been straightened, a number of tubes, depending upon the size of the boiler, are temporarily fastened to both sheets to permit the removal of the straightening bars, after which the balance of the tubes can be inserted and the operation completed.

It is general practice, with tubes which are beaded at one end and the other end expanded only to cut them the desired length before inserting into the tube sheets. Some times there is more or less variation in the lengths of the tubes in which case the tube sheet is divided into sections, the tubes of each section being cut the same length. They are then marked for their respective sections, and when in stalled all will project from the street about the same distance.

If the tubes are to be beaded at both ends, then the measurements should be taken with more care, and the variation between the sections should not exceed 1-16 of an inch. Some boiler manufacturers design their boilers so as to use a special length of tube. All the tubes are usually about the right length and those that project too far beyond the sheets are cut off at the desired point by a special machine, although frequently a flat chisel and hammer is used. Tubes expanded into the sheet and not beaded should not extend beyond the sheet over 3-16 of an inch. Those which extend too far beyond the sheets not only prevent proper expansion but also permit the surplus part of the tube, which is not cooled by the water, to be burned or wasted away.

The Rolling Feature.

Tubes are tightened into the sheets by means of a roller or sectional expander. When the tube is inserted into the hole it should project beyond the sheets 3-16 to ¼ of an inch, which amount is allowed for the bead. The tube is held temperarily by lipping the tube with a hammer as indicated in Fig. 3. The lip will hold the tube in position while it is being expanded. Usually about four turns of the expander will force the tube out against the sheet. The use of a heavy maul for driving the mandril should be discouraged, as the blows struck upon the mandril should not be heavy enough to cause the tube sheet to warp or spring.

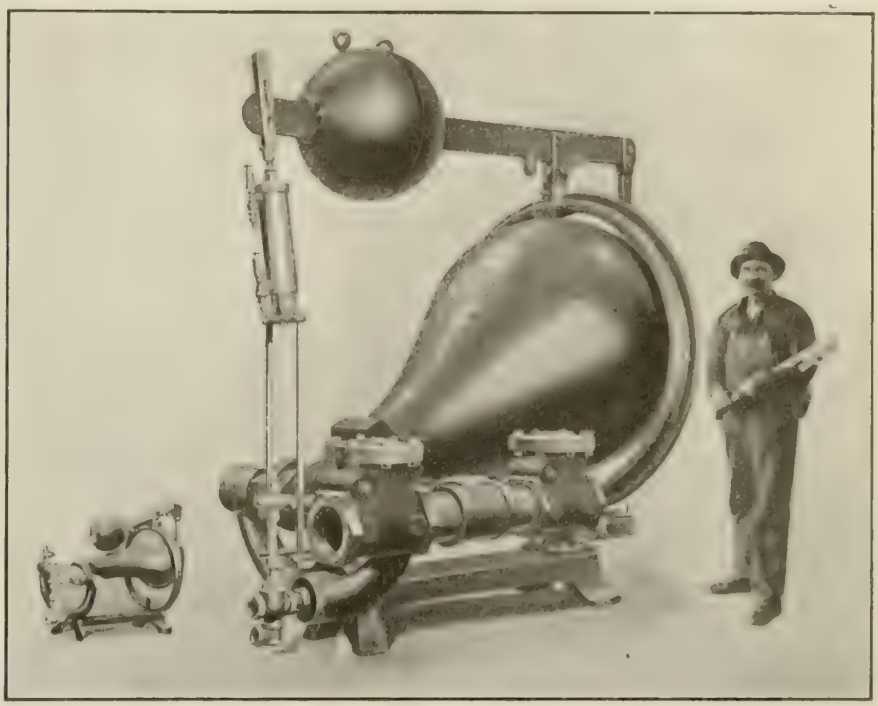
The tubes ought to be worked to the sheet, and if this is done properly the sheet will not be distorted. A large tapering pin should never be used to enlarge the tube. The copper ferrules are annealed before being put into place and must be a neat fit. If too small for the hole, they may be stretched and reannealed. In expanding tubes with the roller expander, the mandril should be forced in only a short distance at a time, otherwise humps will form and make the rolling unsatisfactory.

In rolling leaky tubes, expand them very lightly and use an ordinary hammer on the mandril. It is not well to remember that heavy pounding is not required to tighten the tube in the sheet, as the tube has already the full contour of the expander. Beading the tube is very important. A beading tool constructed with a sharp heel is very liable to result in the sheet being cut when the bead is calked. In Fig. 4 is shown a beading tool having a sharp heel, also the manner in which it cuts the sheet, while Fig. 5 shows a beading tool with a square heel which prevents the cutting tendency.

THE LARGEST STEAM TRAP IN CANADA.

THE illustration herewith shows the largest steam trap that has yet been installed in Canada. This huge Bundy trap was recently suuplied by H. L. Peiler & Co., Montreal, to the Quebec and St. Maurice Industrial Co. at La Tuque, P.Q.

All the high pressure drips in this large pulp plant are returned to a closed receiver, and then go back to the boiler through the return trap. The trap has 4-inch inlet and outlet connections, and returns 50,000 lbs. of water per hour to the boilers, handling nearly half a ton of water at each operation.



THE LARGEST STEAM TRAP IN CANADA.

The shipping weight was 3,200 lbs, and the trap stands 6 ft. 6 in. in height. In spite of the great weight, the adjustment of the dash pot is so sensitive that the valve closes with absolutely no jar.

BOILER SHELL FORMULA QUERY.

By John J. Grancis.

IN the November issue of The Power House there appeared a very clear and concise report by T. J. Main on the recent boiler explosion at Collingwood, Ont. Ont. I shall be glad, however, to have an explanation concerning the fraction .69 appearing in the numerator of the formula there given, and mean-

time presume that his calculation is based on the following general and universally accepted formula for arriving at the working pressure of steam boiler shells:—

$$W.P. = \frac{TS \times t \times E}{R \times F}$$

where (TS) = tensile strength and (t) the thickness of the shell plate, (E) the lowest efficiency of shell plate and rivets at the longitudinal seam, (R) the radius of the boiler shell, and (F) the factor of safety. If (E) or .69 in Mr. Main's formula is the lowest efficiency of shell plate or rivets at the longitudinal seam, what is the tensile strength of the plate and the shearing strength of the rivets allowed by him?

Editorial Explanation.

It is quite evident from Mr. Main's formula in both instances that 60,000 pounds per sq. inch has been taken as the ultimate tensile strength of the shell plate, and his idea in using it on the second occasion, with a much reduced shell plate thickness and most certainly bereft of more or less of its original strength, even if it did happen to have been 60,000 pounds per sq. inch when new, is intended to demonstrate more clearly that, even under such circumstances, 25 pounds per sq. inch working pressure was the limit of the boiler instead of 80 pounds—the pressure carried, when it blew up.

Regarding the shearing strength of the rivets, we have no doubt Mr. Main reckoned this at from 82 to 85 per cent. of the tensile strength of the plate, and although it does not appear to be definitely stated in the article covering the report, the longitudinal shell seam must have been of the double riveted lap type, at least. The omission to note the type of joint in the report naturally induces speculation relative to the fraction .69 in the formula, especially as one would gather from the data generally that the joint was only single riveted lap, and would have, as a consequence, a rivet section value of but .56.

In a succeeding issue we will endeavor to have Mr. Main indicate the type joint and make whatever additional observations he cares to.

THE UTILIZATION OF A BY-PRODUCT—EXHAUST STEAM.

By Wilbert Sailer.

AT this time when increased efficiency and reduction of power costs are vital considerations in connection with the operation of manufacturing plants, it might be well to call to mind in a general way some of the many methods for effecting appreciable economies by the utilization of the exhaust steam which is usually available as a by-product. This whole matter assumes greater significance when it is remembered that from 80 per cent. to 90 per cent. of the heat imparted to the feed water in the boiler is present in the exhaust steam after passing through the engine cylinder. The foregoing statement may be checked up by assuming a typical case.

Typical Case.

Take, for example, a medium-sized plant, using automatic non-condensing engines, which consume, say, 25 pounds of steam per i.h.p. at 100 lbs. gauge pressure. Reference to a steam table will show that 1,157 heat units must be added in the boiler to the feed water at 60 deg. to produce one pound of steam at the pressure named. Hence, 25 lbs. of steam will require the addition of 28,925 heat units. When the steam is admitted to the engine, it is (1) turned into useful work; (2) dissipated through radiation losses, drips, etc.; or (3) swept out with the exhaust steam.

The heat involved in the first operation may be easily calculated; the losses experienced in the second operation can be closely estimated; while the difference between the sum of the heat consumed in these two operations and the total heat carried in the steam will, of course, represent the heat available in the exhaust. The first calculation may be made as follows:

Since one heat unit equals 778 foot pounds of work, by dividing this 778 ft. lbs. into 33,000 ft. lbs. per min. per h.p., we get 42 heat units required per h.p. per minute. Multiplying this 42 heat units by 60 minutes, we get 2,520 heat units per hour consumed in developing one horse-power of work in the engine. Radiation losses may be estimated conservatively at from 5 to 10 per cent. of the total heat of the steam, and adding this radiation loss to the heat consumed in the engine, we find that but 16 to 19 per cent. of the heat developed in the boiler to produce one h.p. of steam, or 28,925 heat units, has been expended in passing through the engine. It is, therefore, apparent that approximately 80 per cent. to 85 per cent. of the heat developed in the boilers at the expense of coal and labor is available for use in many plants in the form of exhaust steam. With these figures in mind there can be no doubt as to the advisability, or, in fact, the necessity of utilizing this exhaust steam, and the question resolves itself into securing the most efficient and economical conservation of this heat.

Before considering, however, the various methods for utilizing this exhaust steam, it is essential that mention be made of means for ridding it of what has in the past proved to be the greatest obstacle against its general use—that is, the elimination of lubricating oil carried in the steam during its passage through the engine cylinders. If this oil is allowed to remain in the steam, even when it does not come into actual contact with the substance being heated, as, for instance, in heating coils, closed or tubular heaters, etc., the accumulation of grease on the heating surfaces greatly reduces the heat transferring efficiency of same. The presence of oil also renders the condensation from such coils unfit for use unless purified of the oily emulsion. In localities where water is of poor quality, or is expensive, the loss of this otherwise pure condensation is quite serious, especially when it is considered that the drips from a 100 h.p. closed heater will amount in a ten-hour run to approximately four to five thousand pounds of pure water. Where the exhaust steam is brought into direct contact with the substances being heated, such as in heating feed water in open heaters, it is absolutely necessary that this steam be free from oil contamination.

PRICES OF SUPPLIES.

By. Chief Engineer.

ALL power houses employes should be told the net cost of the various supplies necessary for running the plant. I can, however, hear in imagination, some owners and managers make sneering comments on such proposition but although the idea may not sound right to a purchasing agent or superintendent, to the owner it should appeal if he cares to save operating costs.

Most engineers must give in a report showing what material has been used, but in many cases he is entirely ignorant of the cost of same. How can any engineer estimate the cost of repairs or renewals if ignorant of the prices of the various materials entering therein. It is usually only a guess and a poor one at that.

In large plants thousands of dollars can be saved every year by carrying out the foregoing idea, and the shrewd business man should see to it that every employe knows at the end of his day's work whether he has made or lost.

BOILER EXPLOSIONS.

By H. T. Westwood.

BOILER explosions are becoming almost as common at automobile accidents. The latter have now ceased to excite more than a passing interest, and the average individual, on reading an account of one, usually dismisses it from his mind with the chance remark—Well, if they will take the risks, they must also take the consequences.

Of Public Interest.

The public, however, cannot afford to regard boiler explosions in a similar

light. It is a question of vital importance not only to the engineer and fireman but to the public at large, involving the personal safety of everyone employed in a building in which a steam boiler is in service, as well as of those who happen to be in the immediate vicinity. When one stops to consider that nearly every large building in Canada is equipped with one or more boilers upon whose safe operation hangs the lives of scores of persons, the gravity of the situation is apparent.

The recent explosion at the saw mill of Manly Chew, Midland, Ont., described in the November issue of the Power House strongly emphasizes two points: —First, the necessity of having all parts of the boiler accessible for inspection; second the necessity of rigid inspection. Failure to comply with the former requirements, however, is no excuse for laxity of the latter.

We should have Government boiler inspectors practical men, and the best that can be found would not be too good to fill the position.

If any part of the boiler is inaccessible it should be the duty of the inspector to demand that the owners provide means for its inspection, and furthermore, he should have the power to withhold the certificate until satisfied that the boiler may be safely operated under the particular operating conditions. Engineers, firemen, boiler makers and inspectors are interested in this matter. They live, move and have their being around steam boilers, and explosions touch them deeper than any one else.

A Criticism.

Being one of the craft, may I not examine and question the verdict of the jury in the Midland case:—

Two men killed and their death was accidental.

What caused the explosion?

Here was a boiler with a double riveted lap jointed longitudal seam, a construction condemed by all experts for reasons that have been explained in Power journals many times. The seams were of lap jointed double riveted construction with the flexure common to that design.

If the plate be weakest, cracks occur. If the rivet section in shear be weakest, then the bending action long continued will result in shearing at mid-section, and granting failure at that point, it follows that the remaining rivets being weaker than the net plate give way by shearing.

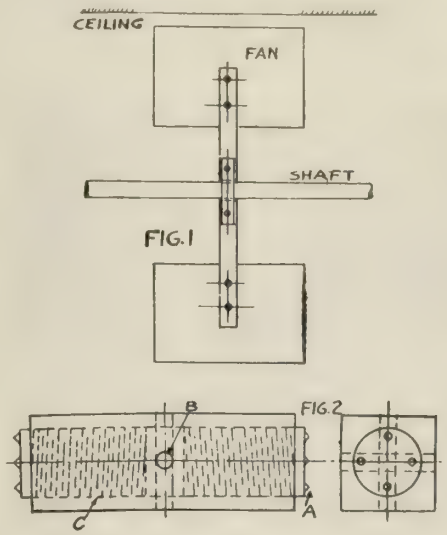
In view of the above the verdict of the Midland jury may be set aside as of no value to the men operating steam boilers. The explosion points out again the danger of operating boilers of this construction. No examination short of a water test with the wall removed to permit the seams being examined is of any real value on boilers of this design, and this test should be supplemented by trams over the seams and by steel tape around the circumference of the shell at several points.

That about two boilers explode every day in the United States, and those in Canada becoming more frequent is by no means credible to those supplying us with reserviors for stored energy.

FRESH AIR DEVICES.

By John Thorn.

I NOTICED a hot weather kink in a shop several days ago. The idea was new to me so it may be new to others. Fig. 1 shows that it consists of fan arrangement attached to a shaft



FRESH AIR DEVICES.

making about 150 revolutions per minute. The sketch is sufficiently indicative of the apparatus to make further description unnecessary.

A Spreader.

In Fig. 2 we have an interesting little tool, not new by any means, but from has been told me it is principally used by "gentlemen," who break out of prison. It is called a spreader and is used for forcing the iron bars on prison windows apart to allow the man inside to get out without using the door. It is about 1¼ inches in diameter and 4½ inches long over all. I am not describing it with the expectation that it will be used as a jail opener, but it is a tool easily made, is very powerful, and care be used by almost any engineer for many different jobs. It is practically a long nut with a right hand threaded bolt in one end and a left hand threaded bolt in the other end shown at (C). Each side of the nut has a hole (B) into which a steel rod can be placed as a lever. The ends of the bolts have sharp points (A) which prevent them from turning.

LETTING IN THE LIGHT.

By W. Huxtable.

I N a recent editorial on boiler explosions, you mention that Canada has the greatest per capita losses by fire of any country in the world. Well, Mr. Editor, who cares? Has not our own banner Province — Ontario—produced one of the greatest farces, entitled an "Act Respecting Stationary Engineers" that the world has ever seen; an act that certifies a man capable to have charge of and operate a steam plant.

Why was such an Act framed? Because the engineers were clamoring for bread and the Government handed them this stone to keep them quiet. The very men who framed the Act must have known that on account of the low standard requirement that the engineers or numbers of them would not be fit or competent men to have charge of or operate a steam plant, and in that supposition they were right. Let me tell you here about a few of the things I have seen Ontario stationary engineers do. One put eight pails of water in a boiler, closed it up, got up steam and finished pumping with his injector. Another connected the steam pipe of his injector to his water column and wondered why he had to shut his injector off and find out where his water was. Another set a slide valve by placing his engine at half stroke and his eccentric at extreme point of travel. These are but a few of the examples that I could name, but they will suffice to indicate my point. I know of one engineer taking the gold cure while holding a certificate, and will any man of reason say that these men were fit to have charge of a steam plant.

Now, Mr. Editor, I see the boys are discussing graded certificates; just tell them to stop it. Any Act worthy of the name will have these. Every profession, trade, or calling has its graduation; even the cattle in their stalls and the pigs in the sty are graded, and why should we be the only exception. What engineers want to talk and howl about is an Act that will give the owner a competent and reliable man, and the engineer protection in the performance of his duties; an Act that will give good Government inspection; and that will cut out inspection of boilers by men of two years' experience. If we can get this, then we can get our self respect back again. We have tried the present Act and found it wanting. We have waited for its results, and the result has been as you have put it, in an epidemic of boiler explosions.

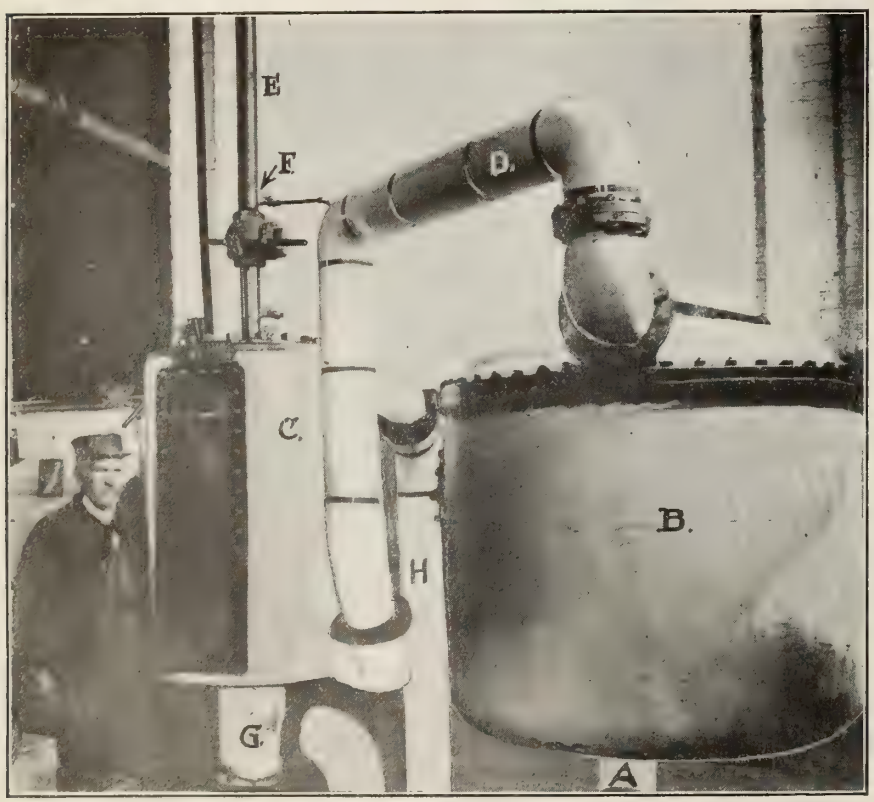
AN UNUSUAL FEED-WATER INSTALLATION.

By B. T. M.

THE economical utilization of waste heat in steam power plants is a constant problem with all superintendents and engineers, but occasionally these problems are presented under such conditions that they are difficulty to solve satisfactorily. Such a problem came before the engineering staff of the Montreal Water Department, where the general conditions were and are unusual.

Montreal is growing at the rate of nearly 30,000 people annually, which means that water has to be supplied each year to nearly 6,000 more families than during the preceding year; or, in other words, every year additional equipment must be put into service, equal to a new pumping plant for a city of 30,000 inhabitants.

It is absolutely necessary to utilize the present site, the low level pumping station with the old buildings, making additions as needed. Upon the completion of the new aqueduct canal, the pumping will eventually all be done with hydro-electric equipment, the steam equipment being then used only as a stand-by, or emergency plant. The question of capital expenditure is an important factor, and makes the cost of an installation of economizers prohibitive.



AN UNUSUAL FEED WATER INSTALLATION.

It was long recognized by the former superintendent, Mr. George Janin, and his then assistant and now superintendent, Mr. T. W. Lesage, that the feed-water system was unsatisfactory and wasteful.

The high-pressure drips consist of the condensation from the steam mains and that from the steam-jackets of the pumping engine cylinders. These were run to an open tank, and into this tank the auxiliaries exhausted; the latter consisting of the main feed-pump and one of the 30 h.p. lighting engines, giving, in all, less than 2,500 pounds of exhaust steam at atmospheric pressure.. All pumping engines run condensing and the vacuum maintained is 27½ inches. With the make-up water added in the open tank and the drip valves left partly open on the cylinder jackets, the temperature of the feed-water varied from 100 degrees F. to 160 degrees F., this including the heat of about 4,000 lbs. of water per hour from the engine cylinder drips, which under 15 lbs. pressure had a temperature of about 240 degrees F. or more on reaching the open tank.

When the present engineer, E. F. Valiquet, took charge of the City Pumping Stations, he at once took the matter up with the superintendent and the city engineer, and the present system has now been in service for several months.

New Installation Details.

In the exhaust line from No. 4 pumping engine, which is rated at 400 h.p., a "Y" fitting was placed close to the condenser, and connected to a 42-coil Reilly Multicoil Heater on the induction principle—(B) in the illustration. The exhaust from the engine under 27½ inches of vacuum, passes to the heater in preference to the condenser, there being an air connection 2 inches from the top of the heater to the point of highest vacuum in the condenser. The feed pump taking water from the city mains forces it by (A) through the primary heater (B) and thence by pipe (D) into secondary heater (C), and thence through pipe (H) to the boiler feed lines. The drip from the secondary heater is shown at (C) while (E) is the exhaust connection to atmosphere, and (F) a back pressure valve.

At the present time, the feed water enters the primary heater at about 40 degrees F., and is raised in the primary heater to 95-98 degrees F., the relative sensible heat in the exhaust steam under 27½ inches of vacuum being 108 degs. F. This exhaust from one 400 h.p. compound condensing pump only, and as the vacuum frequently attains 28 inches, is a very satisfactory result, considering that the total feed for 2,500 h.p. boilers is treated. In the secondary heater the water is further raised according to the quantity of water being passed. The final temperature varies from a minimum of 110 degrees F. to maximum of 185 degrees F., the average temperature being about 140 degrees F. All the auxiliary exhaust is condensed in the secondary heater, and in fact it has been found necessary to keep this slightly open to the atmosphere to prevent the formation of a vacuum.

All the high presure drips are returned under pressure direct to the boilers by means of a Bundy Return System, and when the proposed new lighting unit is in operation, and a further primary unit installed on the exhaust line of the 12,000,000 gallon condensing pump now being erected, the average temperature of the total feed water for 3,000 h.p. boilers will probably reach 170 degrees, and this will be attained altogether by the use of waste steam, and at a total cost of $6,000, resulting in an estimated saving of about $15,000 annually.

The most interesting feature of the system consists in the ultilization of the exhaust under the high vacuum. This has been done elsewhere on a smaller scale, but we believe that this is the only case in Canada where it is being successfully operated on so large a basis.

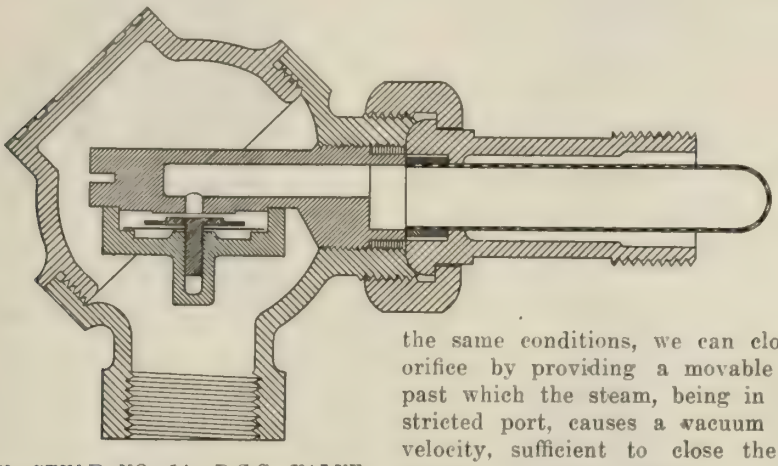
The "Reilly" Multicoil Heaters were supplied by H. L. Peiler & Co., of Montreal and Toronto, while the actual installation was made by the engineers of the pumping station under the supervision of Superintendent Lesage and E. F. Valiquet, engineer-in-charge.

PROGRESS IN NEW EQUIPMENT

There is here provided in compact form a monthly compendium of the power plant manufacturers' achievements.

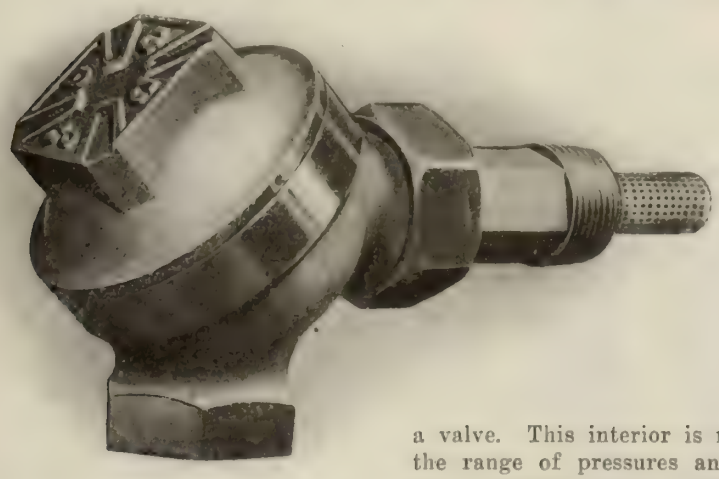
THE D. G. C. VALVE.

THERE has recently been introduced into this country by the D. G. C. Valve Co. of Canada, Home Life Building, Toronto, a return valve of distinctive design. The idea of the inventor, Prof. Brown, was to separate water and air from steam by the difference in their velocities of discharge from an orifice into a condition of lower pressure. The velocity of the liquid discharging from an orifice is proportional to the head, while that of air is also proportional to the pressure, but with a higher constant. In the case of steam, on the other hand, the tension is relaxed and its velocity through the orifice is very high. Taking advantage, then, of this discrepancy in discharge velocities under the same conditions, we can close the orifice by providing a movable valve, past which the steam, being in a constricted port, causes a vacuum by its velocity, sufficient to close the valve against its normal pressure on the same valve.



SECTION, STYLE NO. 1A, D.G.C. VALVE.

The section of a D. G. C. valve, as this return valve is called, shows how this is accomplished. The interior consists of a plate, comprising ports, orifice and seat, with detachable bridge, which guides the movable spindle that acts as a valve. This interior is made to suit the range of pressures and discharges to be handled, and is screwed into a suitable body, as illustrated.



STYLE NO. 3B, D.G.C. VALVE.

The mechanical and thermodynamic efficiency of this device has been demonstrated, we are informed, in New York and Boston in some of the largest and most carefully designed buildings. It is in operation in such plants as the General Electric, where it is subjected to the most critical observation; also in the various New York terminals; the railroads, after elaborate tests, having adopted it for service in caring for train pipe line drips.

In Canada a number of installations have been made, covering hospitals, factories and office buildings, and considerable interest is being evinced in the operative results.

LINE OF POP SAFETY VALVES.

IT undoubtedly will be interesting to readers to learn of the many varieties of Pop Safety Valves that it is necessary for a company to manufacture if they would comply with the different conditions of service and meet the requirements of discriminating engineers. Probably no other concern in the world manufacture as large and complete a line of Pop Safety Valves as do The Lunkenheimer Company, Cincinnati, Ohio. Space will not permit of a complete description of every design manufactured, and we therefore confine ourselves to their principal product, the "Sentinel," the important features of which, however, are carried out in all the different designs. Illustrations are shown of their general line, with short descriptions.

All Bronze Type.

The Lunkenheimer "Sentinel" Pop Safety Valve is made either entirely of Bronze, Fig. 1, or with iron body, bronze mounted, Fig. 3, and as the working parts are identical, a description of one will suffice for both. Reference is therefore made to Fig. 1, which illustrates the bronze construction.

When a pop valve is ordered, the purchaser, as a rule, stipulates the pressure at which he desires tthe valve to relieve, but after the valve is connected, certain conditions may arise that require a resetting of the valve. It is not necessary, however, that the entire valve be taken apart for this purpose, it being only necessary to remove the lever U, then the bonnet C, when access can be had to the regulating screw L. Should it be desired to have the valve relieve at a higher pressure than that for which it was set.

the regulating screw L is turned down, placing a greater load on the spring, and for a lower pressure, it is turned up, which relieves the load.

It is usually found that after a valve has been reset, it will either relieve too

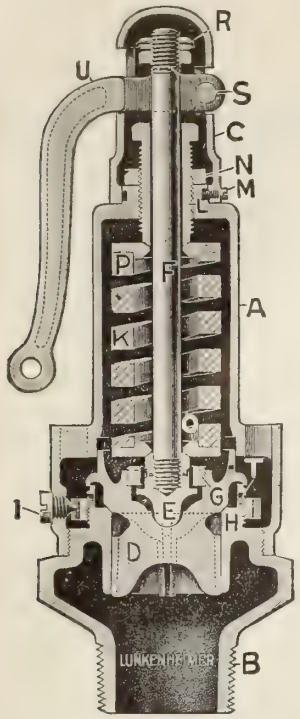


Fig. 1. Sentinel, Bronze, Top Outlet Pop Safety Valve.

much or not enough pressure. This is rectified by a regulating ring H located in the base of the valve, and which screws over an extension of the seat. The object of this ring is to cover or uncover, as the case may be, a series of holes T drilled around the extension of the seat, and by removing the set screw I and inserting a wire, the regulating ring H can be turned up or down.

Fig. 2. Sentinel, Bronze, Side Outlet Pop Safety Valve.

By turning the ring H up, covering the holes, only a small quantity of steam can escape through these holes, which places a large amount of pressure on the bottom of the disc flange or lip, giving it a higher lift and holding it longer off its seat, thereby allowing considerable steam to escape and a proportionate amount of pressure.

Turning the ring H down, uncovers the holes, allowing the free escape of steam through them, but inasmuch as the pressure on the bottom of the disc flange is

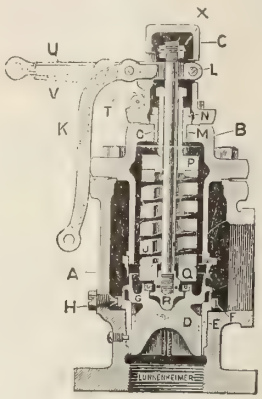


Fig. 3. Sentinel, Iron Body Bronze Mounted Pop Safety Valve.

decreased, the disc will not rise very far off its seat, closes quicker, permits but a small amount of steam to escape, and, therefore, a small reduction of pressure. This construction enables a very wide

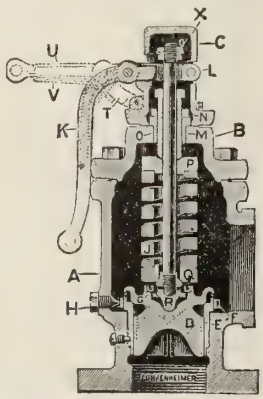


Fig. 4. Plain Pattern, Iron Body Bronze Mounted Pop Safety Valve.

range in reduction of pressure—from as low as one pound to as high as fifteen pounds, depending, of course, on the pressure carried in the boiler.

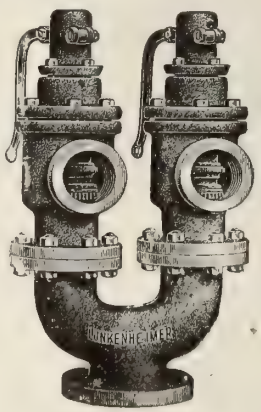


Fig. 5. Twin Pop Safety Valves.

It will be noticed, by reference to Fig. 1, that an extension on the top of the disc G fits within the bottom of the bell A. The object of this is to thoroughly encase the spring K, thereby protecting it from the corrosive action of the steam. The valve shown in Fig. 1 is of the top outlet pattern, but where it is desired to have the escaping steam exhaust at a distance from the valve, the angle pattern, Fig. 2, should be used, which permits of the connection of a pipe at the side.

Iron Body Types.

A comparison of Figs. 3 and 4, which illustrate iron body types, will show that the working parts are practically the

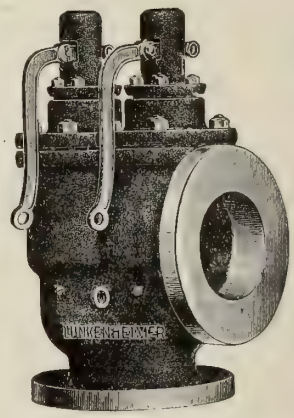


Fig. 6. Duplex Pop Safety Valves.

same, but that the spring casing has been omitted in Fig. 4, and the spring is consequently not protected from the steam. In some cases, however, it is not considered essential that the spring be encased, hence the necessity of a design like Fig. 4, which is known as the "Plain Pattern."

The use of large size pop valves is in a number of cases not only objectionable, but, when these come above 5 inches, is prohibited. It is, therefore, necessary to use two smaller valves having a com-

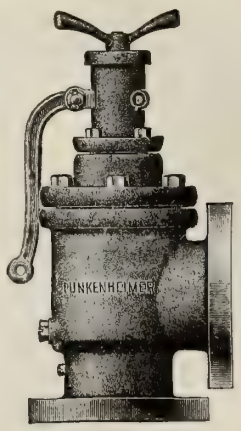


Fig. 7. Marine Pattern Pop Safety Valve.

bined area equal to that of the required large size valves, and for this reason the constructions shown in Figs. 5 and 6 are designed.

Fig. 5 illustrates the "Twin" Pop Valve, which merely consists of two

separate valves attached to a suitable base or Y, while Fig. 6 shows the "Duplex," in which two independently operating valves are encased in one body. Both have their advantages: with the "Twin," for should one of the

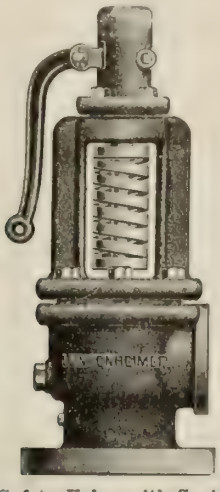


Fig. 8. Pop Safety Valve with Spring Exposed.

valves become damaged beyond repair, it can be replaced with a new valve at a less cost than the "Duplex." On the other hand, space may not permit of the use of the "Twin," and consequently,

Fig. 9. Locomotive Pop Safety Valve.

the "Duplex" must be resorted to. In some cases, no objection is had to the escaping steam within the boiler room, and therefore, no pipe connection is made to

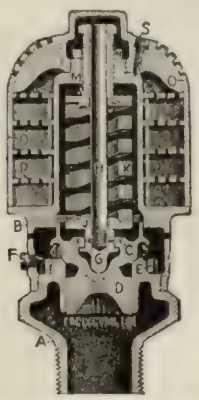


Fig. 10. Pop Safety Valve with Muffler.

the outlet. Should it be desired to have the steam exhaust at a distance from the valve, the "Duplex" would then have the advantage, inasmuch as only one pipe connection is necessary, whereas the "Twin" would require two.

Marine Pattern.

Fig. 7 illustrates a type of valve generally known as the "Marine" Pattern. It differs from the "Sentinel" Pop Valve, shown in Fig 3, only in the addition of a wing handle at the top of the valve, the object of which is to conveniently enable the turning of the disc on its seat for regrinding purposes, or while the valve is under pressure, to remove slight incrustations that may lodge on the seating surfaces.

An improved form of valve is shown in Fig. 8. In this construction, the spring is exposed, the principal advantages being

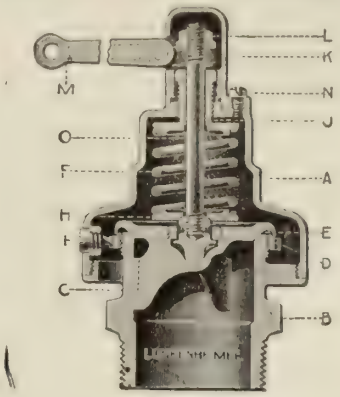


Fig. 11. Alert Pop Safety Valve for Steam Heating Boilers.

that the spring is positively protected from the steam and that it is at all times accessible for inspection. This valve is particularly well adapted for use where superheated steam is used, as the extremely high temperatures cause the springs to rapidly lose their tension. The construction of the working parts is

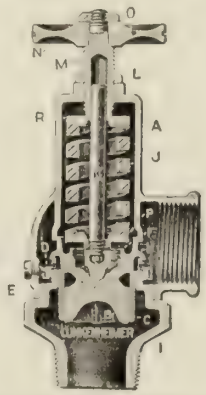


Fig. 12. Gas Pop Relief Valve.

practically the same as the valve shown in Fig. 3.

Locomotive Pattern.

For locomotive service the valve shown in Fig. 9 is generally used. It is similar to Fig. 1, with the exception that the lever for operating the valve by hand is omitted, which complies with the requirements of railroads.

To reduce the objectionable noise of the escaping steam, the valve shown in Fig. 10 is furnished. This construction consists of a series of perforated plates through which the steam is free to pass, but as the velocity of the steam is greatly retarded by the time it reaches the top of the bell, the noise is almost entirely overcome. This valve is used to great advantage on hoisting engines, steam tractors, steam shovels and other steam generators used in exposed places or upon the highways.

Heating Boiler Pattern.

The "Alert" Pop Safety Valve shown in Fig. 11 was designed for use on heating boilers. It is so designed that the pressure in the boiler cannot exceed 15 pounds per square inch, which is the maximum pressure generally carried in boilers for steam heating purposes. It is provided with a padlock to prevent tampering with the setting, but even though access was had to the regulating screw J, the same could not be turned down any further than the shoulder at the top would permit, thereby preventing setting over 15 pounds. The valve, of course, can be set to relieve at any pressure under 15 pounds, if desired.

Gasoline Production Pattern.

The form of Pop Valve shown in Fig. 12 was designed to comply with the requirements of the recently developed industry of producing gasoline from natural gas. For this purpose, a valve must be so constructed that an intermittent, reliable popping and closing action must be insured, because the degree of economy obtainable, depends largely upon the positive operation of the valve.

As this valve is subjected to severe service, the seat is made of a hard nickel composition, and the valve in general is of heavy construction. If desired, it may have the hand-wheel, as shown, to facilitate regulation of the pressure, but it can also be had provided with a plain cap at the top, similar to that shown in Fig. 9.

Steel or Semi-Steel Valves.

Manufacturers of Pop Safety Valves are sometimes called upon to furnish valves made of materials other than brass or iron, such, for instance, "puddled" semi-steel or cast steel, but while the demand for these or other materials is very limited, nevertheless, if a manufacturer wishes to broadly cover the field, he must not only be prepared to furnish a large number of designs, but he must also be in a position to supply them made of any material called for.

In the valves illustrated, the springs are large, are made of high grade steel, and rest between ball and socket plates, so that the pressure on the disc is equally divided. It will also be seen that the discs are well guided at both the top and bottom, insuring reliable seating.

These valves are claimed to relieve positively and promptly when the pressure in the boilers exceeds that for which they are set, and they can be regulated without taking them apart.

NEW TYPE OF CONDENSING TURBINE.

TWO main objects have been kept in mind in the design of the latest type of Terry condensing turbine. These were an economy approaching that of the larger units used in power installations, and the overcoming of the old trouble of air leakage into the condenser.

This air leakage, it is claimed, has been completely overcome. The only gland exposed to vacuum has been shifted from the end of the casing to the middle, where it is exposed on one side to vacuum and on the other to steam at just above atmospheric pressure. This makes the leakage of air through this gland almost an impossibility.

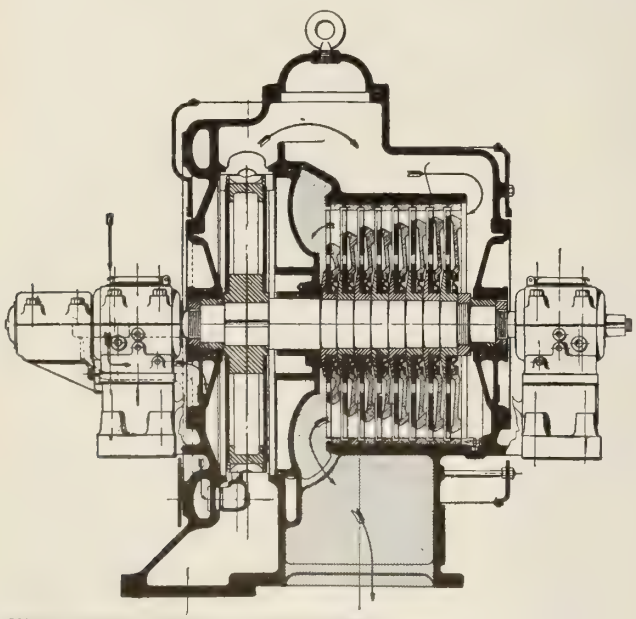
The machine consists essentially of a regular Terry multi-velocity wheel as the high pressure element, and a low-pressure end consisting of several multipressure impulse elements. The main feature distinguishing the arrangement of this low-pressure element lies in the fact that it has been turned end for end, receiving steam at the end farthest from the high-pressure element and exhausting into the condenser connection at the centre of the turbine. By this simple device of reversing the flow of steam, and thus protecting the vacuum glands, the old trouble of air leakage has been eliminated.

This turbine has the regular Terry characteristics, including casing split on the axial plane, permitting examination of the runner without disturbing steam or exhaust connections. It has the Terry indestructible high-pressure element which permits starting up the turbine from cold, even though a large quantity of water is thus thrown through the blades.

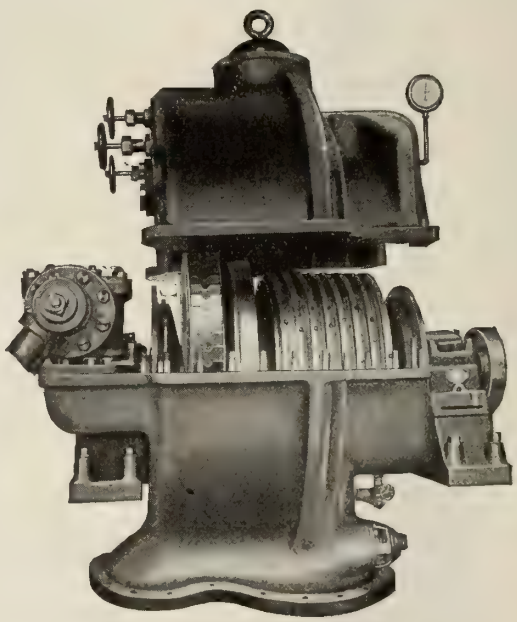
The stationary buckets in the low-pressure end are placed on annular rings, from which they may be removed in blocks as necessary. These rings are not fastened to the casing, but are bolted together and remain with the runner when the casing is removed, as will be noted in the illustration. They are held by friction to the casing when the upper half is drawn down tight to the lower half, and, hence, always retain their position when the turbine is running. The arrangement makes it very simple to examine all parts with a minimum of trouble.

The method of swinging the casing from the bearing blocks instead of from the base, makes it always concentric with the runner. Expansion is radial, and all clearances are maintained practically the same when the turbine is running as when it is cold. The side of the bearing in the pillow block is cylindrical. This is bored at the same time as the casing and from the same centre. It follows, therefore, that under no circumstances can the axis of the runner get out of line with the axis of the casing.

This new design of turbine is being applied to three principle uses:—Driving electric generators, blowers and centrifugal pumps. In all these uses we are informed the Terry turbine has made such a record that fully 80 per cent. of the more than 1,600 units which have been been put to work have been sold on repeat orders. It is of interest that the largest number of repeat orders have come from the United States navy and the British admiralty—two customers of extremely critical tendencies and requiring exceptionally severe tests of every unit purchased. There are more than 300 Terrys in use in these two services, all three of the above purposes being represented.



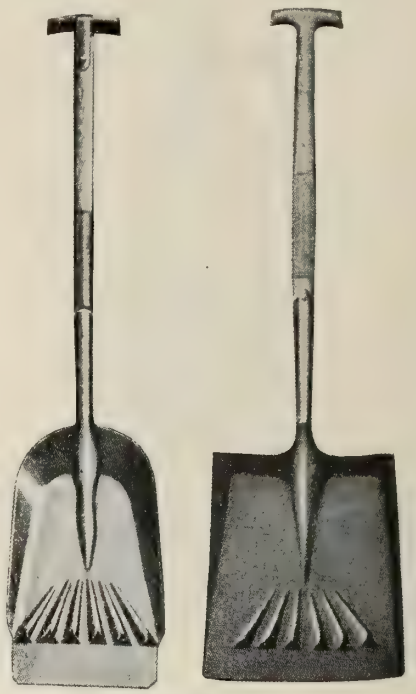
NEW TYPE TERRY CONDENSING TURBINE.



NEW TYPE TERRY CONDENSING TURBINE.

SPRINKLING SHOVEL FOR BOILER FIRING.

IN the September, 1912, issue of The Power House there appeared an article, entitled "Improved Hand Firing," the substance of which was the adoption for steam boiler firing purposes of a special type shovel designed to sprinkle the fresh fuel over the fire grate. Mr. C. A. Fell, Sheffield, England, a specialist in the subject of fuel economy, developed this particular type appliance, and it is of interest to know that George A. Marshall, 70 Lombard Street, Toronto, is distributing agent for it in Canada.



SPRINKLING SHOVEL.

By means of the fan-shaped projection on the firing surface of the shovel,

the fuel is spread so finely over the fire that the gas is driven off suddenly and ignites very quickly. In this way the furnace temperature is kept up to a maximum and so far from an extra supply of air being necessary, the draught may be lessened by partly closing a damper. The shovel is designed to get a similar effect as with a mechanical stoker of the sprinkling type, and thus the amount of steam generated in the boiler is increased by the sprinkling action without the necessity of going to the high first cost of the mechanical stoker. This is particularly advantageous in districts where manual labor for stoking is cheap, while the cost of buying, transporting and erecting a mechanical stoker would be correspondingly heavy.

It may be argued that the fire needs firing oftener, and, therefore, the fire door has to be opened oftener, but the door is not kept open for such long intervals at a time owing to a less number of shovelsful being necessary to cover the fire. Further, owing to the thin layer of fire used, it is not necessary to open the fire doors so often for raking, slicing and poking. Again, as less draught is necessary, there is obviously a less quantity of excess air drawn through the flue when the fire door is opened, and, therefore, the boiler and its setting is not cooled down to such an extent during the firing and raking operations.

This simple modification of the ordinary firing shovel is a distinct step in the direction of boiler economy, and has the additional advantage of training the fireman automatically in the production of a high rate of steaming.

THE UEHLING TRIPLE DRAFT GAUGE.

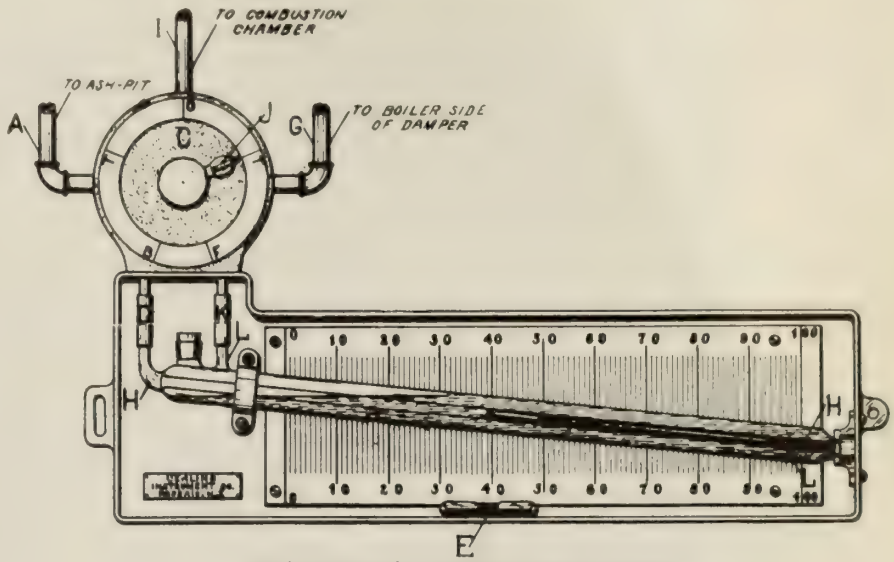
THE ordinary draft gauge shows the drop of pressure between the boiler room and the damper, but this information, although not without value, is insufficient to serve as aid to the fireman to properly control his fires. Draft so measured is composed of three distinct components:

First, the drop of pressure from the boiler room to the ash pit. This may be negligible if the ash pit doors are wide open, or it may be considerable if they are partially or nearly closed.

Second, the furnace draft, i.e., the drop of pressure between the ash-pit and the furnace, that is, the resistance through the fire. This factor varies: (a)—with kind of fuel; (b)—with the physical condition of the fuel; (c)—the thickness of the fuel bed; (d)—the condition of the fuel bed, or the evenness of fire; (e)—the thickness of the ash bed; (f)—the physical condition of the ash bed, contents of slate clinker, etc.; (g) construction and condition of the grate; (h) the condition of the grate.

Third, the boiler draft, or the drop of pressure between the furnace and the damper. This depends upon the type of boiler, the manner of setting, baffling, etc., but in any given boiler varies only with the volume of gas passing through i.e., the rate of driving.

Total draft is the force which induces combustion; but since its effectiveness depends on so many continually changing conditions, its indication can neither serve as a measure of the rate of combustion nor as an aid in the proper control of the fire unless analyzed into the several factors composing it. This is claimed to be accomplished by the Uehling Triple Draft Gauge here illustrated.



THE UEHLING TRIPLE DRAFT GAUGE.

It consists of a deep metal box frame with a wide scale attached to the bottom. Attached in front of this scale in an inclined position is a large glass tube (LL) containing a small tube (H) which protrudes from (LL) at its upper end; (H) and (L) respectively are in communication with the five-way valve (C) through the connections (D) and (K). Valve (C) is further connected through suitable pipes (A) with the ash pit, (I) with the furnace and (G) with gas exit between the boiler and the damper. The valve (C) is operated by a movable index (J) which revolves in front of a dial upon which the letters (O), (T), (F) and (B) are shown. When index points to (O), (H) and (L) are in communication and the gauge shows zero. When it is moved to (T), (H) and (L) are in communication respectively with (A) and (G) and the gauge shows the total draft, i.e., the drop of pressure between the ash pit and damper. When the index is moved to (F), (H) and (L) respectively communicate with (A) and (I) and the gauge shows the furnace draft, i.e., the drop of pressure or resistance through the fire. If the index is moved to (B), (H) and (L) respectively communicate with (I) and (G) and the gauge shows the boiler draft, i.e., the drop of pressure between the furnace and the damper. Thus, the draft can be analyzed at any moment and the true conditions ascertained. This information very materially aids any intelligent fireman in getting good results.

This gauge is equally applicable to boilers served with forced or induced draft, as to those depending on natural draft, because it measures the resistance through the fire and the boiler, separately or collectively as desired, irrespective of the pressure in the ash pit. The boiler draft is a measure of the volume of gas passing through the boiler, hence an index to the rate of driving. With the aid of this gauge the firemen can always see whether he is driving his boilers at the proper rate.

To know whether he is running efficiently he must have a CO_2 indicator as well, the per cent. of CO_2 being the only true guide to economical firing.

John Turner, of the Smart-Turner Co., Hamilton, Ont., underwent an operation for appendicitis on Sunday last.

Angus Smith, late city engineer of Regina, has been appointed city engineer of Prince Albert, Sask., in place of H. Baker, resigned.

A. F. Yarrow, of Yarrow & Co., shipbuilders, Glasgow, accompanied by his son, N. A. Yarrow, visited Victoria last week, after visiting Vancouver, New Westminster, and other British Columbian cities.

POWER PLANT DEVELOPMENTS

A record of current municipal, manufacturing and general industrial projects, involving steam, gas, oil, electricity, air and water power equipment requirements.

Electrical

Forest, Ont.—The by-law to issue debentures for $7,500 to complete the electric light plant has passed committee stage.

Winnipeg, Man.—The city has secured a contract to supply light to Ward 4, Transcona, for $2,000 a year.

Port Moody, B.C.—The town has awarded a contract to the B. C. Electric Railway Co. for the installation of 30 lights.

Winnipeg, Man. — The Linton-May-Lush Electric Co., Ltd., have been incorporated as electrical engineers, with $20,000 capital.

Neepawa, Man.—A by-law authorizing the expenditure of $18,000 on improvements to the electric light plant will shortly be submitted to the ratepayers.

St. Catharines, Ont.—The city finds 2,000 h.p. Hydro-Electric power insufficient for its needs. A new industry now being negotiated will require 1,000 h.p.

Sandwich, Ont.—The ratepayers will vote in January on two by-laws, one to take Hydro-Electric power, and the other to provide money for installing the system.

St. John, N.B.—A generating plant with a capacity of 500 h.p. is being installed in the new elevator here; also a small lighting machine of 50 h.p. The W. J. O'Leary Co. are in charge.

Waterloo, Ont.—The contract for supplying a turbine pump and electric motor, with capacity of 400,000 gallons, has been given to the Canadian Allis Chalmers Co., Ltd., Toronto, by the Water and Light Commission.

Hamilton, Ont.—The Hydro-Electric Commission have decided to supply power to the Township of Barton. Hamilton has been asked to construct the plant and supply the power, but the commission may do it.

Niagara Falls, Ont.—A report from Binghampton, N.Y., says that a power plant will be built costing several million dollars, on the Canadian side at Niagara Falls. Surveyors have already been at work, according to reports.

Fort William, Ont.—The Mount McKay and Kakabeka Falls Railway Co. offer to supply 1,000 h.p. to the city at $18 per h.p. The Hydro-Electric Commission offer 1,000 h.p. at $24, with substation and other equipment.

South Vancouver, B.C.—It is planned to build a municipal electric lighting and power plant at a cost of $300,000, and to generate current by steam turbines driven with steam generated in oil burning furnaces. A gas plant is also talked of.

Grenfell, Sask.—The opening of the electric light plant in the town of Grenfell took place on Monday, November 10. The steam engine was supplied by Ruston Proctor & Co., Lincoln, Eng., and the electrical machinery by the Canadian Westinghouse Co., Hamilton.

Orillia, Ont. — The Hydro-Electric Commission of Ontario have made an offer to supply power to the town. The commission is prepared to pay the town $100,000 for its power plant, etc. In the meantime the Water, Power and Light Commission will not go ahead with the erection of a power plant at Swift Rapids.

Victoria, B.C.—Part of the plant of the Vancouver Island Power Co. at Jordan River has been out of commission as a result of the washing away of the grade along which the flume line runs. In the meantime the auxiliary power plants are being operated to capacity.

Smithers, B.C.—Arrangements for the immediate installation of the first unit of the electric light plant have been made by W. J. O'Neill, and his associates. The power-house, work on which will begin at once, will be located on Fourth Avenue. The plant will supply 500 lights, and will be supplemented if not sufficient.

Peterborough, Ont.—The Electrical Power Co. has refused to accept the city's offer of $95,000 for the distribution system of the Peterboro' Light and Power Co., which is controlled by the Electrical Power Co. The city council has therefore, appointed R. A. Ross, of Montreal, as arbitrator in the proceedings which are to follow.

Sandwich, Ont.—The Sandwich town council has asked the Hydro-Electric Commission for information regarding the cost of installing the Hydro system in the town, and what a probable rate would be. Councillor O'Brien thinks that the town will get cheaper power from the Edison Company.

Toronto, Ont.—The contracts signed with the Hydro-Electric Commission for power by Owen Sound, Meaford, Thornburg, Markdale, Flesherton and Chatsworth will necessitate the construction of a transmission line to Collingwood, which will cost approximately $500,000. The Government will take the matter up at once, as well as provide money for the development plant at Eugenia Falls.

Niagara Falls, Ont.—The building of a suspended raceway to tap one-half of the waterfall from the Canadian Falls and one-half from the American Falls at Niagara River to a point where a power plant will be erected for the generation of electricity is the plan of Frederick Walker, No. 39 Broadway, New York. The raceway will cost about $2,500,000.

Hamilton, Ont.—The Dominion Power and Transmission Co. will build its steam plant to develop 90,000 h.p. near Stewart Park on the bay shore. It is rumored that the company will devote the surplus to operating electric lines, and that it will extend its H. G. & B. line to Niagara Falls, improve its H. & D. line and extend its B. & H. line to Galt.

South Vancouver, B.C.—Electrical Engineer Rawden has urged the municipal council to establish a new system of street lighting. He stated that, with the present system, 100 arc lamps cost $4,500 a year to maintain, while 25 flaming arc lights, he said, would cost approximately $1875 to purchase, and $1,125 a year to maintain. He suggests that as additional lights are needed, 75 arc lights be replaced by 25 or 30 flaming arc lamps, and that the 75 ordinary lamps be distributed where most needed.

SIEMENS BROS. DYNAMO WORKS | SIEMENS BROS. & CO.

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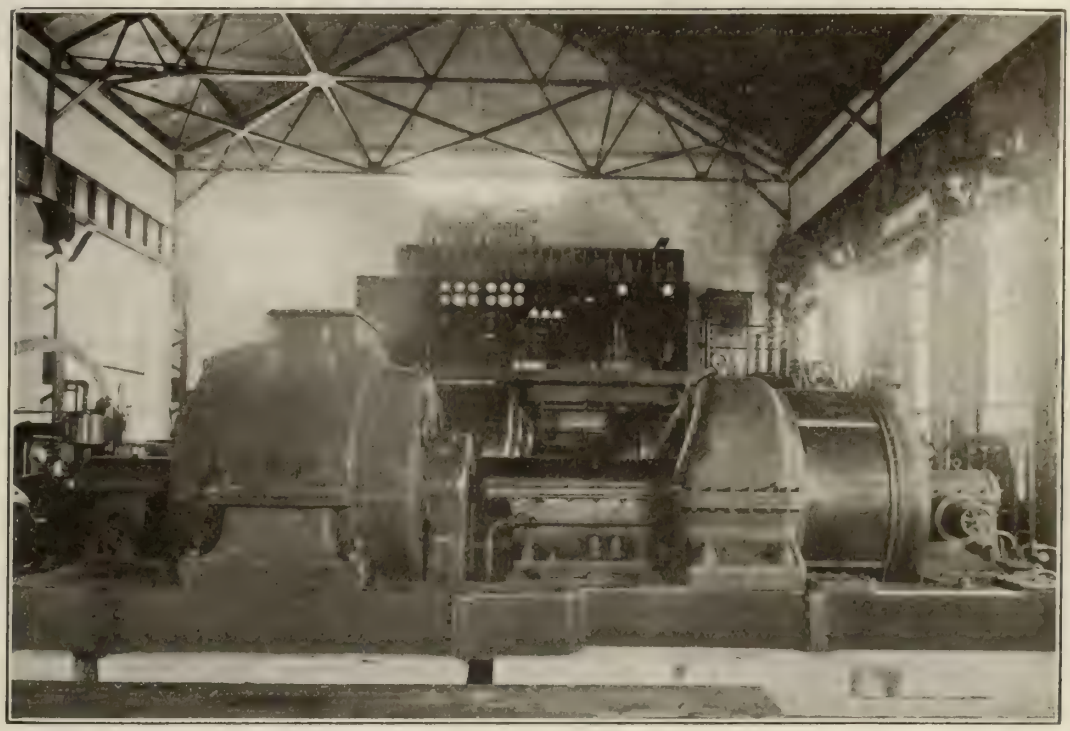
SIEMENS



Siemens 2500 K.W., 25 Cycle, 6600 Volt Turbo Generator with Switchboard, supplied to the Dominion Coal Company, Nova Scotia.

The following Siemens Turbo Generators have been supplied or on order for Canada:

1—4,000 K.W. Edmonton.
1—2,500 K.W. Dominion Coal Company.
3—2,000 K.W. Dawson City.
1—2,000 K.W. Edmonton.
2—1,500 K.W. Regina.
1—1,500 K.W. Lethbridge.
1—1,500 K.W. Moose Jaw.
1— 750 K.W. Nova Scotia Steel and Coal Co.
2— 750 K.W. Medicine Hat.
2— 500 K.W. Nova Scotia Steel and Coal Co.
1— 500 K.W. Wayagamack Pulp and Paper Co.

The Siemens Companies have supplied more than 100 Turbo Generators of 4,000 K.W. or over.

Siemens Company of Canada, Limited

HEAD OFFICE:

Transportation Building - MONTREAL

BRANCH OFFICES:

STANDARD BANK BUILDING
TORONTO

McARTHUR BUILDING
WINNIPEG

Contracts Awarded

Vancouver, B.C.—The Mannesmann Tube Co., of London, England, recently supplied the city with 80,000 feet of steel pipe.

Hanley, Sask.—A contract has been awarded to the British Canadian Engineering and Supply Co. for a producer gas electric plant.

Niagara Falls, Ont.—The Hydro-Electric Commission has awarded the contract for an extension to their power house at Falls View to Wells & Gray, Toronto, for $7,000.

Municipal

Raymond, Alta.—The town will enlarge its reservoir next spring.

Mimico, Ont.—Carl Grobba is extending his waterworks which supply the town.

Nelson, B.C.—Ratepayers have voted in favor of purchasing the Nelson Gas Co. plant.

Brockville, Ont.—The municipal gas plant will be extended by the installation of new retorts.

Montreal South, Que.—The town council is considering a water and drainage system. Mayor Smillie.

Aylmer, Ont.—The waterworks and electric light department is in the market for a Duplex steam pump.

London, Ont.—The present equipment of the London incinerator will have to be increased shortly.

Swift Current, Sask.—The ratepayers will be asked to vote $15,000 for the installation of a fire alarm system.

Verdun, Que.— The Verdun council are asking the Quebec Legislature for power to construct conduits for electric wires.

Toronto, Ont.—A new water supply costing $100,000 is planned, and six miles of 6, 8, 12, and 16 inch mains will be required.

Galt, Ont.—The city will construct a large reservoir at the pumping station, and will require stand pipe and new mains.

Winnipeg, Man.—Surveying for the Greater Winnipeg water project has started, and as soon as the rights-of-way have been secured, a telephone line will be installed between Winnipeg and Shoal Lake. Actual construction will be begun next spring.

Stratford, Ont.—The by-law to guarantee the bonds of the Avon Hosiery Co., which was defeated, will be re-submitted.

Forest, Ont.—The ratepayers have granted the council authority to spend $6,000 on extensions to the electric light system.

Castor, Alta.—The ratepayers have voted $20,000 towards the completion of a gas well and extension to the gas lighting system.

Richmond Hill, Ont.—The town will spend $4,000 on a municipal electric light system if the by-law for this is passed on January 5.

St. Boniface, Man.—The ratepayers, on November 5, carried a by-law for $300,000 for sewer construction, and another for $50,000 for waterworks extensions.

Humboldt, Sask.—By-laws providing $103,547 for a waterworks system, $57,700 for sewerage, and $20,500 for extensions to electric light system, have been prepared.

Regina, Sask.—The Canadian West Natural Gas Co., represented by T. A. McAulay, has offered to supply natural gas in three years at 25 cents for power and 40 cents for domestic use.

Stamford, Ont.—The Jenckes Machine Co., St. Catharines, offer the council a standpipe without cement base, 16 ft. diam., and 80 ft. high, for $4,500. The town is installing a waterworks system.

Winnipeg, Man.—Representatives of the American Well Works of Aurora, Ill., A. W. McLean and Geo. W. Igo, were here November 13, in connection with the contract for the supply of a pump for some of the city wells.

Port Arthur, Ont.—On advice of T. Aird Murray, the treatment plant of the new sewage system will be put in the south-west end of the city, and a pumping station will also be established. The expenditure will amount to $250,000.

Montreal, Que.—Fire Chief Tremblay reports that the new fire hall at 25 Drummond Street will be ready in the early spring. The city will equip this hall with a motor engine of 12,000 gallons pumping capacity; one hose waggon, and one ladder truck, costing $28,000.

Ottawa, Ont.—It is probable that at the January elections Ottawa will vote on a proposal to establish a municipal gas plant. A special report presented to the council shows that the city can supply gas for 85 cents per thousand feet, as against $1.10 now being charged.

Morrisburg, Ont.—The corporation have entered action for the return of the power plant now supplying the Hydro-Electric Power Commission of Ontario. In 1912 it was placed in the hands of J. L. Sharkey, who was to re-open his steel sheet plant. Later it is alleged, he made an assignment of the power plant to the Rapids Co., who took it to supply the Hydro-Electric Commission with power.

Refrigeration

Markham, Ont.—F. T. Newton has purchased a site for an abattoir.

Ottawa, Ont.—The ratepayers will vote on a civic abattoir proposition.

Berlin, Ont.—The local medical officer of health strongly urges the city to erect an abattoir here.

Lethbridge, Alta. — Delaney's, Ltd., have bought a site on which they will erect a packing plant.

Hamilton, Ont.—The question of establishing a civic abattoir will come before the council next year.

Niagara Falls, Ont.—It is proposed to convert the new Queen Street skating rink into an ice-making plant.

New Glasgow, N.S.—John T. Nickerson, Liverpool, N.S., will erect a cold storage warehouse some time early in the new year.

Lennoxville, Que.—Messrs. H. P. Hooper & Sons, of Boston, Mass., are contemplating the erection in Lennoxville of an up-to-date butter making plant and cold storage.

Montreal, Que.—The Centerfreze Sanitary Ice Co., Merchants Bank Building, is having plans and specifications completed for its proposed 100-ton ice-making plant.

Steveston, B.C.—The B. C. Granitoid Co., who have the contract for building the new Columbia Cold Storage Co. plant, have begun work, and expect to complete the building by the spring.

Quebec, Que.—The recently formed Quebec Abattoir Co. will build next spring. Representatives of the company are visiting other plants, getting suggestions. The company have decided to go into the canning business.

New Westminster, B. C.—The Columbia Cold Storage Co. have refused offers made by the city, and will move their plant later to Prince Rupert. They have also awarded a contract for a plant at Steveston, B.C., to the B.C. Granetoid Co. for about $100,000.

Why Is the Liberty Cleaner the Best?

Cyclone for Air or Steam with "Norivet" head.

Because the freely swinging arm has a hammering as well as cutting effect, and reaches clear to the iron. No other cutting head has this special feature.

Because, the motor driving the cutters has the power to do the work quickly.

Because, the work can be done at a low cost for repairs.

Because, on account of their construction they will operate successfully under less pressure than any other type of air, steam or water cleaner.

Because, most of the large power plants have found it the best and most economical, and have adopted it as standard, and finally,

Because, it has proven its superiority over other types of cleaners in hundreds of hard competitive trials. If you have tried out any other cleaner and failed, let us send you a Liberty to show you what a real Cleaner will do.

Liberty Manufacturing Company

6904 Susquehanna Street PITTSBURGH, PA.

Canadian Representatives:
Williams & Wilson, Ltd., Montreal. A. R. Williams Machinery Co., Toronto and Winnipeg.

"TWINS" EXCITE ADMIRATION

Because They Earn It

Think of a TWIN when you hear the word STRAINER

The installation of a Twin Strainer on your water supply line eliminates troubles, worry, waste of time and expense—because

It has two straining baskets—that may be cleaned alternately, thus permitting continuous operation.

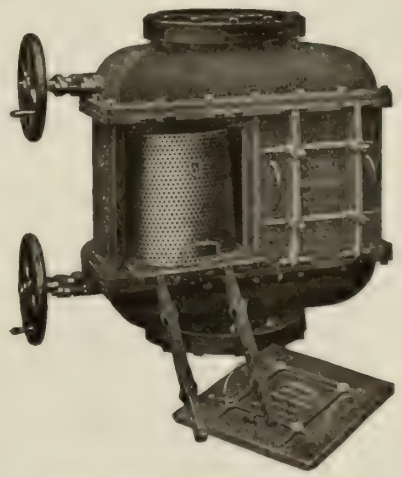
It has but two valves—they are of the gate type and are always tight.

It gives a direct flow with minimum friction loss, insuring easy operation with no waste of energy.

In fact, a Twin Strainer is an insurance policy in active service.

Designed to protect and built to last.

Write for our bulletin.



THE TWIN STRAINER.

ELLIOTT COMPANY

6902 Susquehanna Street, PITTSBURGH, PA.

Manufacturers of Filters and Grease Extractors, Separators, Blow-off Valves, Feed Water Heaters and General Power Accessories.

CANADIAN REPRESENTATIVES:
Willams & Wilson, Ltd., Montreal. A. R. Williams Machinery Co., Ltd., Toronto and Winipeg.

The advertiser would like to know where you saw his advertisement—tell him.

Burlington, Ont. — The Burlington Skating Rink Co. have applied for a charter, with a capital of $10,000. The Preston Metal Sheeting and Roofing Co. will erect the building. Edward Dickenson and John C. Smith are interested.

New Westminster, B.C.—The B. C. Packers' Association have informed the City Council that they do not wish to move the Columbia Cold Storage Co.'s plant to Steveston, B.C., but must be granted facilities by the city for erecting a new plant at once.

New Westminster, B.C.—Tenders for building a plant, to cost altogether $200,000, have been called by the Columbia Cold Storage Co., New Westminster, who will build their new plant in Steveston, B.C. The tenders received vary from $70,000 to $174,500.

Windsor, Ont.—The General Storage, Forwarding & Ice Co. has been organized by H. J. Green and others, with $200,000 preferred stock and $300,000 common stock. The company is planning to build a 5-storey warehouse, partly cold storage, and in connection a 100-ton ice-making plant.

Trade Gossip

Gorman, Clancy & Grindley, of Edmonton, have offered an engine, boiler and steam pump valued at $2,300 for the use of students at the Edmonton Technical School.

The Herbert Morris Crane & Hoist Co., Toronto, have been awarded the contract for a ½-ton hand-operated crane by the Dominion Government, to be used for handling crucibles of molten gold in the Royal Mint. Owing to the excessive heat in this department, it will be necessary to make special arrangements for the lifting gear.

The York Manufacturing Co., makers of refrigerating machinery, York, Pa., have recently installed the following machines in Canada: Northeastern Lunch, Montreal; one 4-ton vertical single-acting belt driven enclosed type refrigerating machine and high pressure side complete; Swift Canadian Co., Vancouver, B.C., one 35-ton horizontal double-acting belt-driven refrigerating machine and high pressure side complete.

Graton & Knight Mfg. Co., the well-known makers of leather belting, whose headquarters are at Worcester, Mass., have found their Canadian business increasing so rapidly that they have decided to add a Canadian depot to their already numerous branch houses. For this purpose they have rented 2,200 square feet of space in the Unity Building, Montreal, which they will fit up as an office and warehouse. A full line of belting will be carried in stock at the above address to enable prompt service to be given to customers. The Canadian business will be looked after by Mr. F. G. Hickey.

The Goodyear Tire & Rubber Co. of Canada, Ltd., has just announced several important changes in the personnel of those at the head of its sales organization. P. D. Saylor, vice-president and sales manager of the Canadian Company, has been made president and managing director of the Goodyear Tire & Rubber Co. (Great Britain) Ltd., with headquarters in London, Eng. R. P. D. Graham, secretary and manager of the Automobile Tire Department, has been elevated to the position of sales director, succeeding Mr. Saylor. H. C. Lower, for some years assistant manager of the automobile tire department of the Goodyear Tire & Rubber Co., of Akron, Ohio, succeeds Mr. Graham as manager of the

P. D. SAYLOR.

tire department. The announcement of Mr. Saylor's transfer across the Atlantic has been received with regret by Canadian automobile and tire men generally, in whose esteem he won a high place. The record he has made, however, justifies their belief in his ability to handle the vast problems which now confront him. As head of the Goodyear Tire and Rubber Co. (Great Britain) Ltd., he will have direct charge of the extension of Goodyear interests throughout the world, outside North and South America. Upon laying down the reins of office here, Mr. Saylor was presented with a magnificent diamond ring by the members of the Goodyear sales force. He carries with him into his new field of labor the sincere good wishes of the whole Goodyear organization as well as of a host of personal friends.

The Canadian H. W. Johns-Manville Co., Ltd., have removed their Toronto branch to more spacious quarters at 19 Front Street, East. This new store and warehouse has a floor area of approximately 35,000 sq. feet, and is situated in the heart of the wholesale district. They will carry a larger stock, and have ample space for the display of their J-M Asbestos Roofings, packings, pipe coverings, building materials, electrical and railroad supplies, automobile and plumbing specialties, etc. The entire building will be lighted by their Frink and J-M Linolite system of lighting, and one room will be used for exhibiting these systems.

The Canadian Fairbanks Morse Co. have just completed a large and modern warehouse and office building, at Montreal, situated on St. Antoine Street, not far from the C.P.R. offices. This building is of concrete construction throughout, and thoroughly up to date in every respect. Instead of the usual sample room floor and offices entirely separate, it is the company's intention to have two main sample room floors with offices combined, so that customers can see the goods they are intending to purchase at the same time as they are discussing them with the various departments. There will be a demonstrating room in the basement, so arranged that gasoline engines, motors, etc., can be seen in operation from the street. Among other novel features will be a customers' waiting room, and an internal water filtration plant.

Personal

George L. Clark, city engineer of Saskatoon, Sask., has resigned.

E. W. Sayer, a well-known electrical contractor, will be an aldermanic candidate in the coming elections in Montreal.

George Janin, chief city engineer of Montreal, has asked leave to retire on a pension of three-quarters of his salary. The Board of Control offer a pension of half his salary.

Dr. John Galbraith, Dean of the Faculty of Applied Science of Toronto University, was the guest of the University Engineering Society last week-end at their annual dinner. Over five hundred were present, including some of the most distinguished engineers in the country.

Miscellaneous

Judge MacTavish heard an action in the Ottawa County Court last week, brought by Harry Lowe against the Ottawa and Hull Publishing Co. to recover payment for engineering work performed. The court was listening to an argument anent the armature, and technical terms were flying thick and fast. Still the judge did not understand, though the lawyers seemed to. At last his Lordship, thinking the subject quite irrelevant, remarked: "I hardly see what this turns on," to which Lowe retorted: "Your honor, it does not turn on anything. It projects out from the main part of the motor and does not turn on anything in particular."

Catalogues

The Gilbert & Barker Mfg. Co., Springfield, Mass., have sent us a catalog dealing with their process for burning fuel oil under low pressure. The merits of oil are discussed in comparison with other fuels, and reference is made to its various uses. A description of the apparatus is given with illustrations of various burners and several installations. The catalog also contains a number of testimonials and a partial list of users of the apparatus.

The Canadian General Electric Co., Ltd., have issued bulletin No. 4966A entitled Hydro-Electric Power developments. The bulletin deals with various large hydro-electric installations made by the company giving illustrations and principal details of each. The descriptive matter deals fully with the equipment installed and the transmission lines in connection, together with illustrations. The bulletin concludes with a partial list of plants where this company's equipment is installed. Copies of this bulletin may be had by writing.

Lunkenheimer regrinding valves are fully dealt with in a booklet which the Lunkenheimer Co., Cincinnati, O., have recently published. A comprehensive description is given of this valve together with a descriptive view showing how it is possible to regrind the valve seat without disconnecting the pipes. The booklet contains price list for complete valves and parts, also diagrams of the various types in connection with which are tables giving leading dimensions of the different sizes made by the company. Copies of this booklet may be had on request.

Triumph Originality is the title of a set of two bulletins which we have received from the Triumph Ice Machine Co., Cincinnati, Ohio. The bulletins are numbered 501 and 511, the former dealing with the construction of the "Triumph" compressor and the latter with the "Triumph" shell brine cooler. Bulletin 501 contains a very full description of the construction of the compressor, with illustrations of various parts, showing some of the principal features. It contains also several outline diagrams, with tables giving chief dimensions of each size. Bulletin 511 gives a description of the construction of the "Triumph" shell brine cooler, together with data for installing and operating, also views of ice plants. These are very attractive bulletins, and the Company will be glad to mail copies by request.

Chas. Barber & Sons

Meaford : Ontario

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Write for Catalogue

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Those who wish to sell or buy a business, obtain competent help, connect with satisfactory positions or secure aid in starting new enterprises, should not fail to use the Want Ad. Page of The Power House.

Do you want to sell or buy a second hand engine or any other equipment? Let The Power House pick out a seller or buyer for you.

There is always some one looking for just such proposition as you have to offer.

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WANTED — EVERY POWER HOUSE IN Canada to remember that C. E. Shedrick, Craig Street West, Montreal, is still repairing measuring instruments, both switchboard and portable. Twenty-five years' experience in repairing all kinds and makes on the market. Integrating meters repaired, tested and sealed, and returned on quick time. (tf)

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[redacted] ENGINEERS

ENGINEERS DESIRING VALUABLE DATA on Boiler Operation, should write for our new booklet—it's free if you tell us where you saw our ad.
The Federal Graphite Mills, Cleveland, Ohio.

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PRACTICAL COURSES BY MAIL IN STAtionary Engineering, Traction, Marine, Gasoline, Automobile, Locomotive, Electric Lighting and Power. Write, stating in what you are interested. Canadian Correspondence College, Limited, Dept. P.H., Toronto, Canada.

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Stand in a Class by Themselves for Quality, Efficiency and Economy
A trial will convince you. Write for Catalog

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TRADE "U.S." MARK
INFALLIBLE METAL POLISH

BEATH CRANES CHAIN BLOCKS TROLLEYS OVERHEAD RUNWAYS

Solve Coal, Machinery and Merchandise Handling Problems.
Hand, Pneumatic and Electrically Operated.

Tell us what you wish to do, and we'll suggest the proper equipment for you.

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It gives pleasure the whole year round and is a constant source of delight, instruction and interest.

All the anxiety and trouble of searching for a valuable and appropriate gift for our friends is simply overcome by giving them a year's subscription of MacLean's Magazine—*Canada's National Monthly Magazine for the business, professional man and his family.*

This makes a gift that is not soon forgotten like an ordinary gift is apt to be—The coming of this distinctive Canadian Magazine each month will recall your graciousness throughout the whole year.

Send in the name or names of your friends with $2.00 for a year's subscription and we will forward them the January issue—the first of the strong one's that will follow each month—The January copies will be ready for mailing on the 15th of December, and will reach your friends amid the Yule-tide Festivities.

The excellent nature of the subjects contained each month will be noted from these features which appear in January:—

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Each Issue portrays one or more snappy articles on Men of to-day.

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Jno. Appleton, Associate-Editor, Financial Post analyses each month the financial outlook.

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The best mineral grease plus the best flake graphite, mixed just right.

The graphite provides the lasting lubricating quality lacking in any grease or oil.

The name "Dixon" is a guarantee of the quality of both grease and graphite.

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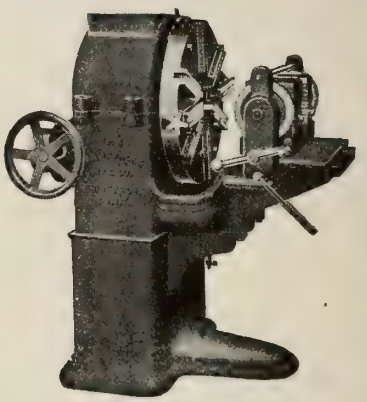
JOSEPH DIXON CRUCIBLE CO.
Established 1827.



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THREADS AND CUTS OFF PIPE FROM 1 TO 6 INCHES
A Very Desirable Machine for
PLUMBERS and STEAM FITTERS
Manufactured by
THE ARMSTRONG MFG. CO.
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Reaches operating superintending and consulting engineers in charge of steam, hydraulic and electrical power plants.

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Mueller Pressure Reducing and Regulating Valves

Give accurate and absolute control of pressures of water, steam, air, gas, oil, carbonic and acetylene gases—in fact, all kinds of pressures. Their efficiency is firmly established. Manufactured under Canadian patent No. 127,566. Address:

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This Belt will save you money on all your direct drives, whether straight or crossed.

Write for our free booklet on Belting information.

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Don't Use Boiler Compounds

Which are always injurious to boilers and valves.

We guarantee an absolute Metal Clean Boiler, when there is sufficient exhaust steam. Get the Nobis habit around your power plant.

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ENGINEER, MANUFACTURER AND HEATING CONTRACTOR
Founded 1880

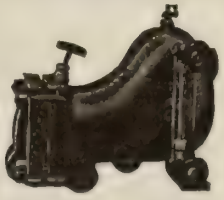
Heating Engineers and Contractors
329 King St. West, Toronto
Phone Adelaide 3669.

Notice to Stationary Engineers

Everyone operating a Stationary Steam Plant of 50 h.p. or over, in the Province of Ontario, must hold a Certificate from this Board. Anyone operating such a plant without a Certificate is liable to the penalties set forth in the Stationary Engineers' Act

HON. J. S. DUFF,
Minister of Agriculture.

W. C. McGHIE,
Chairman of Board,
Parliament Buildings, Toronto



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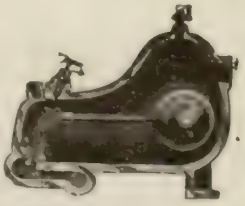
FOR HIGH OR LOW PRESSURE.

Steam can't blow through. They have large discharge valves and cannot be flooded from sudden flushes of water.

MAY WE SEND ONE FOR TRIAL?

Reducing Valves, Pump Governors, Relief Valves, Exhaust Pipe Heads, Ejectors and Steam Separators. SEND FOR CATALOGUE.



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WATSON & McDANIEL CO.,
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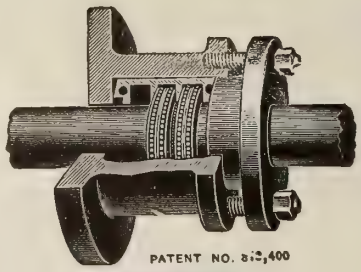

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HOLMES'
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Lasts many times longer. 30 days trial. Less oil. No cutting. Easily applied to any Steam Engine, Air Compressor or Gas Engine. Satisfaction or no pay. Write us.

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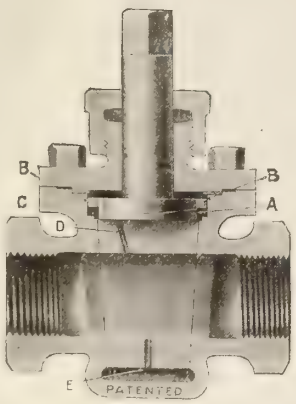
Make Scale removal Cheaper—

because they are more efficient, because they are scientifically compounded to counteract just the impurities in your feed water and nothing else.

Commercial Boiler Compounds are not a chemical mixture, claimed to be a universal panacea for all boiler ills, but are carefully suited to specific cases.

Send feed water for analysis.

Commercial Oil Co., Ltd.
Hamilton, Ont.



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in valves on your steam, hydraulic and pneumatic machinery, and the leaks in operating costs by specifying

"HOMESTEAD"

Straightway Valves for work on all high pressure and acid lines. They are plug valves that can't stick under any pressure. They don't corrode. **Send for Catalog "R" which tells fully about them.**

Homestead Valve Manufacturing Company
Pittsburgh, Pa., U. S. A.

Eugene F. Phillips Electrical Works, Limited
MONTREAL CANADA

Bare and Insulated Electric Wire

Electric Light Line Wire. Incandescent or Flexible Cords.

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Americanite, Magnite, Office and Annunciator Wire. Cables for Aerial and Underground Use.

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The freight and duty is the same on **high grade coal** as on medium or low grade coal.

Our **Lone Star** small coal is **guaranteed** to show 14,000 B.T.U.'s regularly.

Our specialty in Canada is high grade coal from Kentucky and West Virginia via Detroit.

Let us have your inquiries, and call on us if in need of **prompt shipment**, via Buffalo, Car Ferry or Detroit.

Ohio & Michigan Coal Co.

Mines in Ohio, West Virginia and Kentucky

Main Office
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CANADIAN ASSOCIATION
OF
STATIONARY ENGINEERS

To the members of the Canadian Association of Stationary Engineers.

As I am unable to see every member personally, I will take the liberty of extending to you through the Power House Magazine

A Merry Christmas and
A Prosperous New Year.

A. KASTELLA
Executive Secretary

Power Plant
GRAND TRUNK RAILWAY DEPOT
Ottawa, Ont.

THE
CANADIAN CASUALTY
AND
BOILER INSURANCE COMPANY

This Company makes a specialty of inspecting boilers under construction, and issues an official Certificate of Inspection, as required by the Laws of Ontario which came into force on the 1st July.

CONTINENTAL LIFE BUILDING
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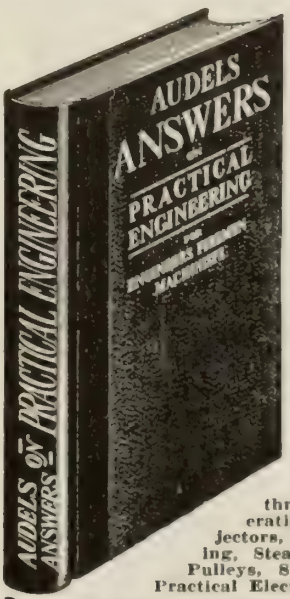

ENGINEERS

THIS book deals largely with the foundation principles which govern the practice of steam engineering. Nothing so soon condemns the applicant as want of knowledge of the every day practice and simple laws relating to the care and management of a steam plant.

No one is expected to know everything, but all are required to be familiar with certain facts which may be called "the beginning of things."

The lack of knowledge of the small things carries conviction of the same lack in the larger.

Plain facts, that you should know, are plainly explained in AUDELS ANSWERS ON PRACTICAL ENGINEERING, answers your questions.

Air, Water, Steam, Fuel and Heat, Steam Boilers, Boiler Construction, Water Tube Boilers, The Steam Gauge, The Safety Valve, Properties of Steam, Installation of Boilers, Management of Boilers, Engineers' Law, Firemen's Law, Steam Engines, The Valve and Valve Gear, The Corliss Engine, Engine Arithmetic, Lubricators, Installation and Operation of Engines, Steam Pumps, Injectors, Feed Water Heaters, Steam Heating, Steam Traps, Belts, Gears and Pulleys, Steam Turbines, Refrigation, Practical Electricity, Elevators.

Understand the framework of which your work is but a cross bar. Know something of the cause of which your work is but an effect. Know something of the effect of which your work is the cause. And, above all, know why it is done one way and not another.

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Sign and mail the coupon, and it will bring to your plant a book of sterling merit, for free examination. You can have one week in which to dig out valuable information contained in its 200 or more pages.

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Do you like going in just as soon as the water is out—hammering away at that hard scale deposit in the hot, humid atmosphere of a freshly emptied boiler?

You don't like it one little bit, and if it weren't for duty—

Well it's not even necessary; it's far pleasanter and decidedly quicker to put **Walker's Electric Boiler Compound** in your feed water, and wash the scale out in the form of mud.

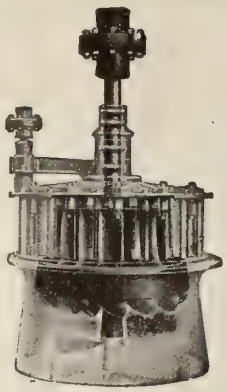
And "Electric" will not injure the boiler or pumps in any way—while it will remove the old scale and prevent new forming.

Send us a sample of your feed water for analysis, and let us ship you a barrel for trial.

Our catalog of power house supplies is yours for the asking.

The Electric Boiler Compound COMPANY, LIMITED

Guelph, Ontario



For All Water Power Purposes

If you have a water power you can use, the "Samson" wheel will develop that power most economically.

The high efficiency shown by this wheel in official tests proves its economy in the use of water, and shows what the wheel will do for you when working under your conditions.

It is easily installed, and when in operation is easily controlled.

The "Samson" is always sold on an absolute guarantee.

Send for Pamphlet V.

William Hamilton Company

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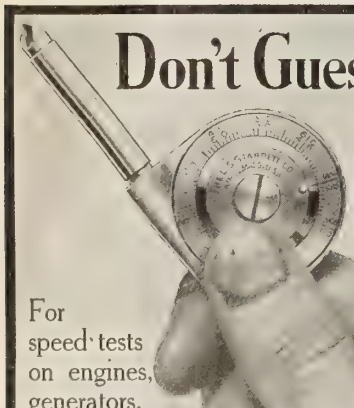
Don't Guess Any More!



With this instrument you can accurately count the revolutions of any revolving part.

For speed tests on engines, generators, turbines, or any machinery, nothing is so reliable and accurate as the

Starrett Speed Indicator

It indicates the highest speed without heating. Small and convenient. Three styles—$1.00, $1.50, and $3.00.

Send for free catalog No. 20 **CD** *and see what style you need.*

The L. S. Starrett Co.

World's Greatest Toolmakers

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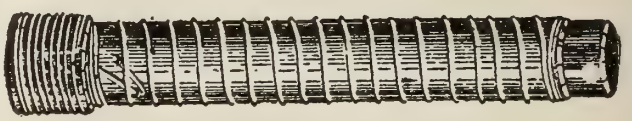

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For city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

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Full Particulars and Estimates Furnished

The Detroit "500" will not syphon

The Detroit "500" Air Compressor Lubricator gives constant lubrication under every condition of service. The rate of feed never varies when changing from pressure to unloading or when returning from unloading to pressure.

The Detroit "500" cannot be robbed of oil and cannot be affected by changing conditions in the cylinder.

This lubricator can be started and stopped without changing the feed adjustment, preventing both loss of time and oil when starting up.

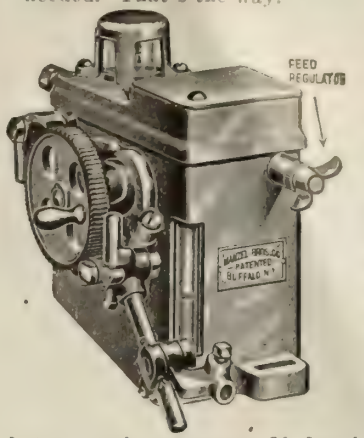
The bullseye gauge and sight feed glasses are kept tight and won't break. This lubricator will withstand the roughest service.

CANADIAN DETROIT LUBRICATOR COMPANY, LTD.

WALKERVILLE, ONTARIO

Oil where it is needed—

when it is needed and in just the right quantity it is needed. That's the way.



The Manzel Sight Feed Oil Pump

will look after lubrication needs.

And it is this careful selection on the part of the pump, this economizing without stunting, that causes the "Manzel" to cut your oil bills anything from 30 to 60 per cent.

Let us send you one on 30 days' trial at our expense. If it doesn't do all we claim, just return it, there'll be no charge.

THE TWIN CITY OIL COMPANY

General Agents for Canada

BERLIN, - - ONTARIO

MANZEL BROTHERS COMPANY, BUFFALO, N.Y.

WHY USE OIL

When GREASE Gives More Uniform Lubrication, Is Better and Much Cheaper?

This Grease Cup will pay for itself many times over with the money it saves in lubricants.

You know that Oil cannot be properly controlled—much of it is lost through dripping.

Grease when used in this Grease Cup is under perfect control until the last drop is used.

The efficiency of this Grease Cup cannot be affected by centrifugal force when used on loose pulleys.

REMEMBER we guarantee it to save 50% over any other system.

Give it a trial and be convinced.

Write for particulars.

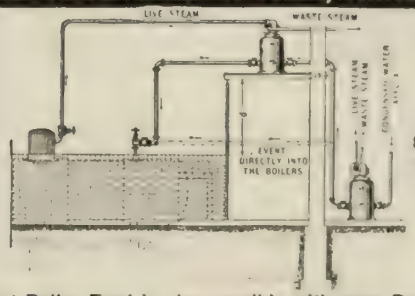
Peterborough Machine and Lubricator Co., Limited

Peterborough, Ontario

Schneider & Helmecke, Magdeburg Germany

RETURN STEAM TRAP FOR FEEDING BACK HOT CONDENSED WATER DIRECT TO BOILER, WITHOUT PUMP.

Founded A.D. in 1876 — GREAT SAVING IN COALS AND WORKING EXPENSES.
INCREASED BOILER EFFICIENCY.
INCREASED LIFE OF BOILER.
MINIMUM OF BOILER INCRUSTATION.



THE MOST RATIONAL — SELF-ACTING BOILER FEED

Direct Boiler Feed is also possible with one Return Steam Trap according to the situation.

Dominion Sugar Company, Ltd. We received your favour of the 5th inst. and noted its contents. To our great satisfaction we are able to inform you that your Return Steam Traps, are working excellently. We have now installed all four, which have worked faultlessly right away from the commencement. — One double Return Steam Trap suffices for conveying the condensed water from 6 Sperber drying apparatus directly back to the boilers. — *Since the Return Steam Traps were installed the feed pump for the boilers of the splitting-drying department has not been used.* — **The saving in coals is considerable,** since by aid of the Return Steam Traps we can now easily keep up full steam, **whereas previously we had constantly to force the boilers to the utmost.** After the experience gained with your condensed water Return Steam Traps we must admit, that no plant ought to be without the same. **The feed pump has always been a unisance to us.**
We leave it to your discretion to make whatever use of this you please.
Wallaceburg (Canada), Ont., Novbr. 22 nd, 1909.

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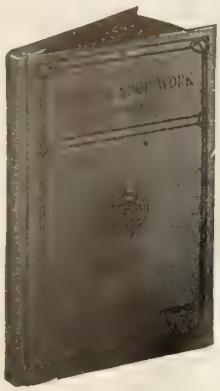
If you are desirous of improving yourself in your trade and so putting yourself in the position of making more money, these Mechanical Engineering Books will be found helpful.



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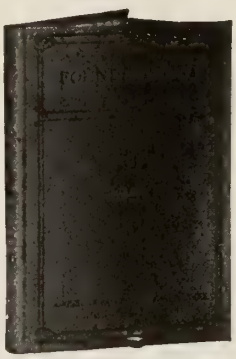
FOUNDRY WORK. By **Wm. C. Stimpson,** Head Instructor in Foundry Work and Forging, Department of Science and Technology, Pratt Institute. 160 pp., 142 illus. Cloth binding. A practical guide to modern methods of moulding and casting in iron, brass, bronze, steel, and other metals, from simple and complex patterns, including many valuable hints on shop management and equipment, useful tables, etc. Price $1.00



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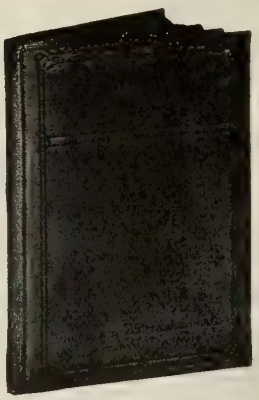

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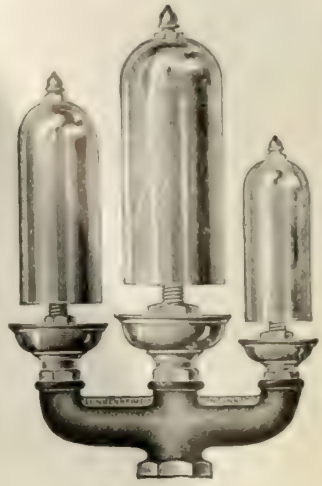

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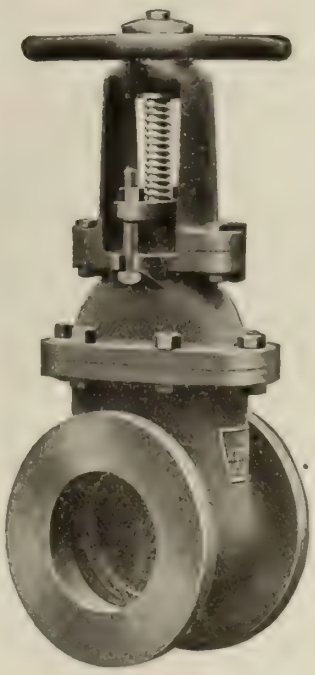

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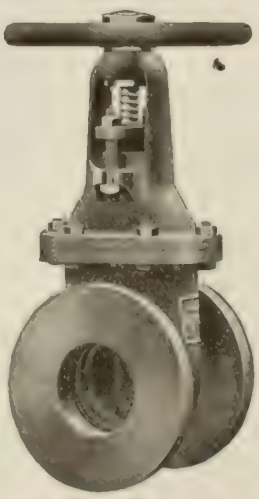

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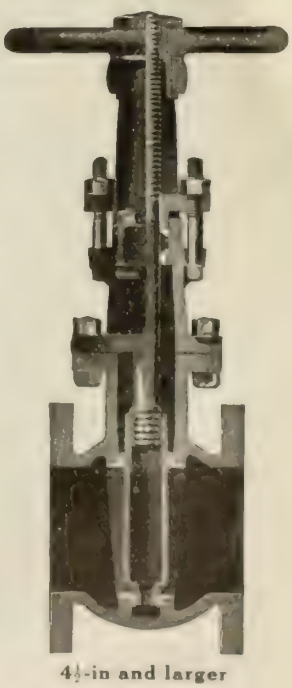

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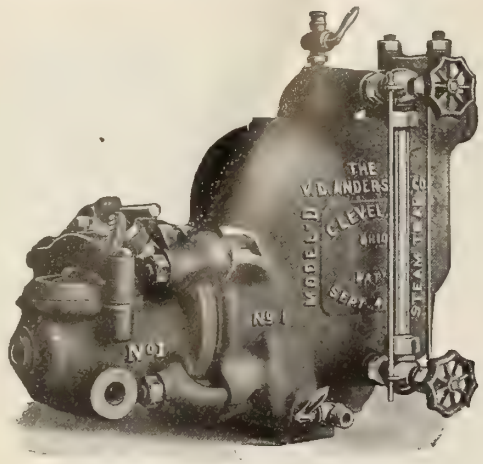

As a sentinel stands guarding the exit from a camp, scrutinizing all who pass, differentiating between friend and foe, so the

Anderson
Model "D" Steam Trap

guards the exit from your steam lines, lets past all condensation, holds back all the steam.

And, like a good sentinel, it makes no mistakes, but steadily and conscientiously drains all the water, without permitting any steam to blow through.

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Send for our booklet describing in detail its many special features.

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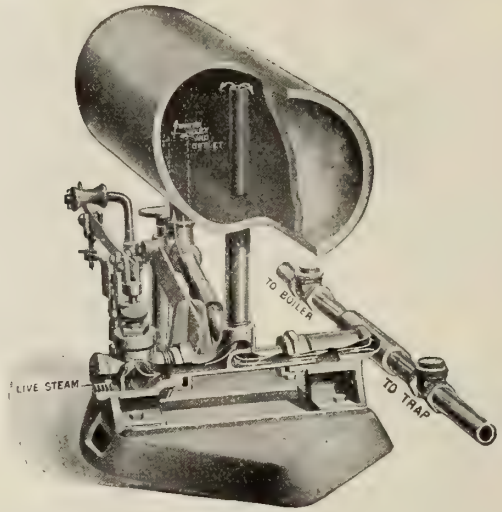
Back to Boiler SYSTEM



Conserve the Heat,

that's in your condensation, the heat that costs you good dollars to put it there. Wasting it is equivalent to wasting money, and when you have to let your condensation cool down before your pumps can handle it back to the boiler, you're wasting heat — you're throwing money away.

Put in a "Morehead" Trap and let it return your condensation just as hot as it comes from the lines, let it conserve the heat and return it to your boilers —where it belongs—let it save you many dollars and give you a better, more efficient method of handling your condensation.

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115,000 in successful operation.

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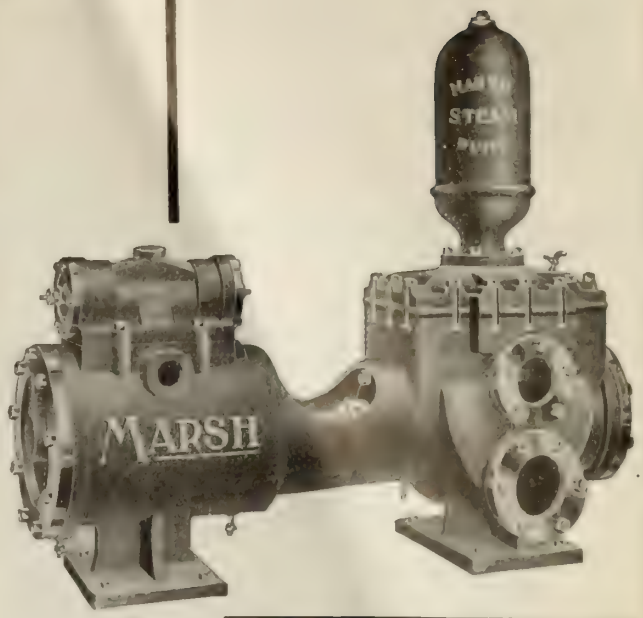

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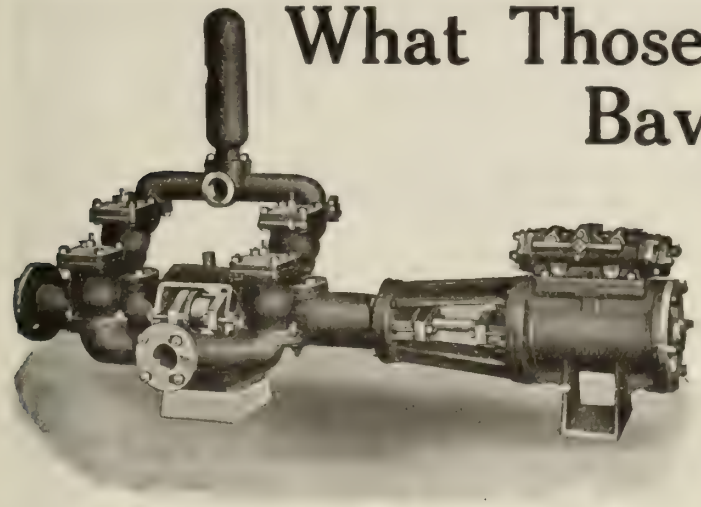

A User:
"I would never know I had a pump, as it needs no attention."

An Engineer Who Has Specified Them on a Number of Large Jobs:
"It is the best pump I ever saw."

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"I don't know another pump made that will stand those tests like that pump."

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"It is the best made pump I ever saw and a credit to Canada."

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"I put them in, they start right off, and I never have a complaint, so they must be good."

A Prospective Customer:
"I called up the users you gave me, and will take your pump."

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Write for Catalogue and Calendar.
And learn why Bawden Pumps cannot Short Stroke or Bang.

¶ The Bawden Pumps are operated by the Bawden Patent Balanced Steam Moved Piston Valves, which insures a Full Stroke of the piston under all conditions. There are no outside rods to stick or get out of adjustment.

¶ The water valves have no screwed seats, but are driven in on a special taper and are held solid by brass stoppers through the covers, all parts made on jigs and faces machined, so no sheet rubber packing is required.

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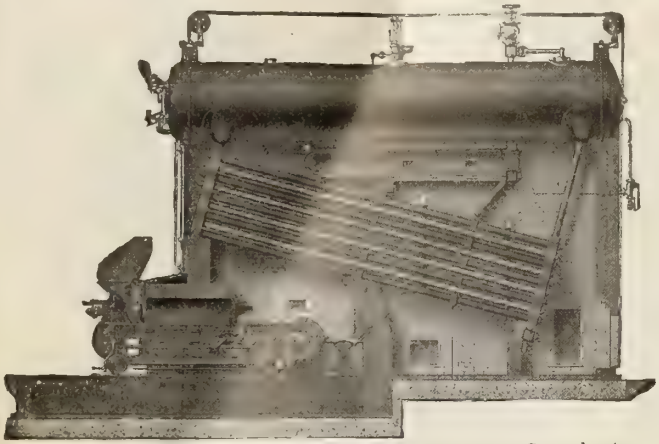

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Jenckes Machine Co., Sherbrooke, Que
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Kerr Engine Co., Walkerville.
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Laurie & Lamb, Montreal.
E. Leonard & Sons, London, Ont.
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Garlock Packing Co., Hamilton, Ont.
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Commercial Oil Co., Hamilton.
Jos. Dixon Crucible Co., Jersey City.
C. C. Snowdon, Calgary.

Governor, Water Wheel.
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Renown Engine & Machine Co., Montreal.

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Imperial Waste & Metal Co., Montreal.

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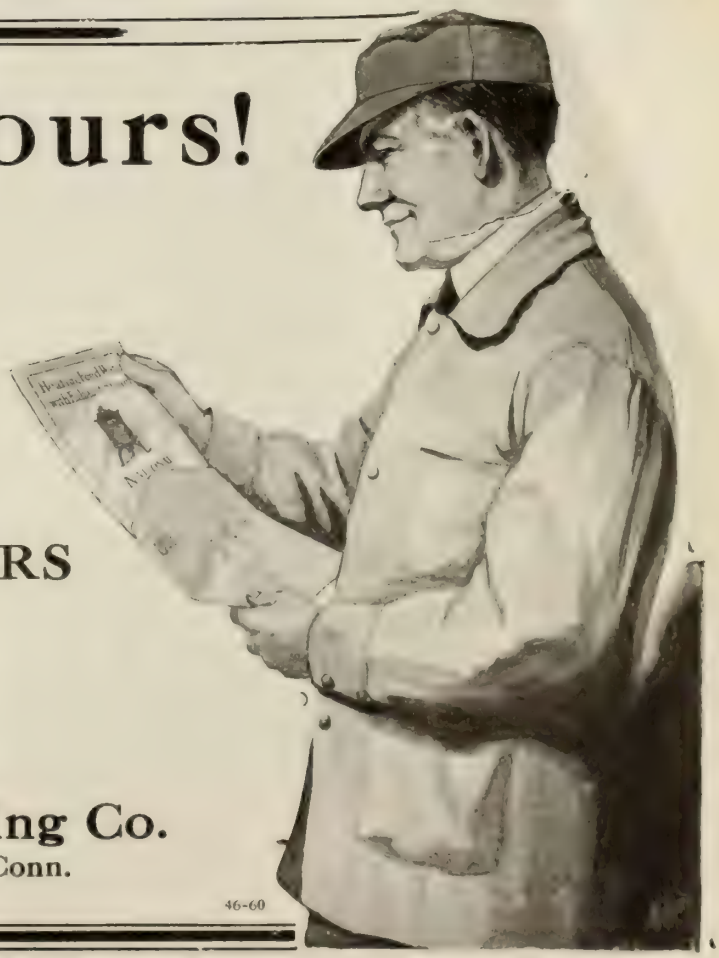

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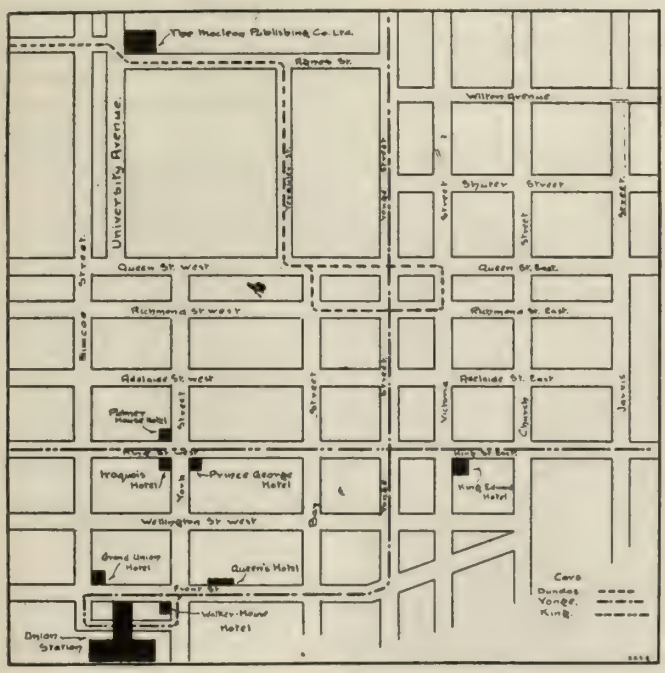
Since we moved up here from Front Street, four years ago, we've been hitherto somewhat inaccessible, and this announcement is to remind you that the "Dundas" car route has been changed, and now runs right past our offices, putting us within four minutes of the down-town district.

The little map shows the car route and the relation of our offices thereto.



All you have to do is to get on any "Dundas" car, downtown, and get off at University Avenue.

As you can now reach us in a few minutes, we shall expect you to look us up, anytime you feel like it.

And, whether you've got any kicks to make, want to talk shop, or just drop around to say "Howdy," we'll be mighty glad to see you.

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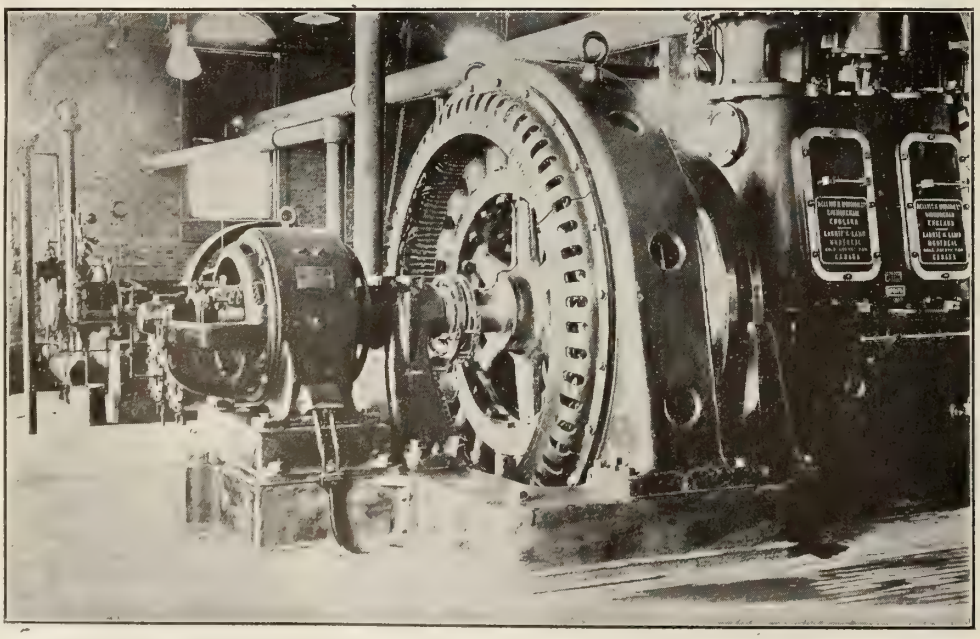

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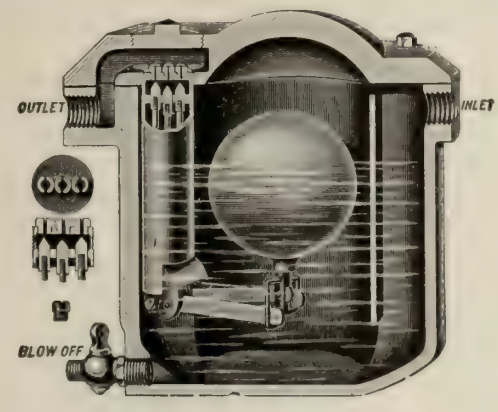

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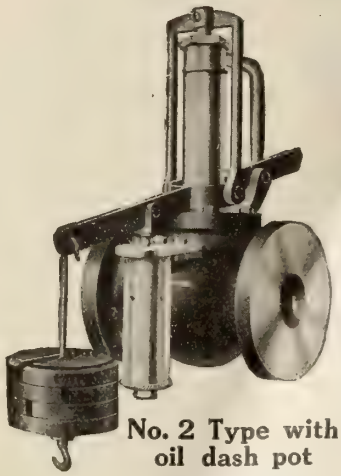

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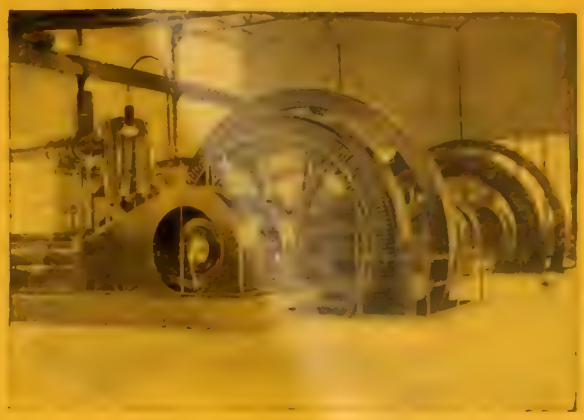

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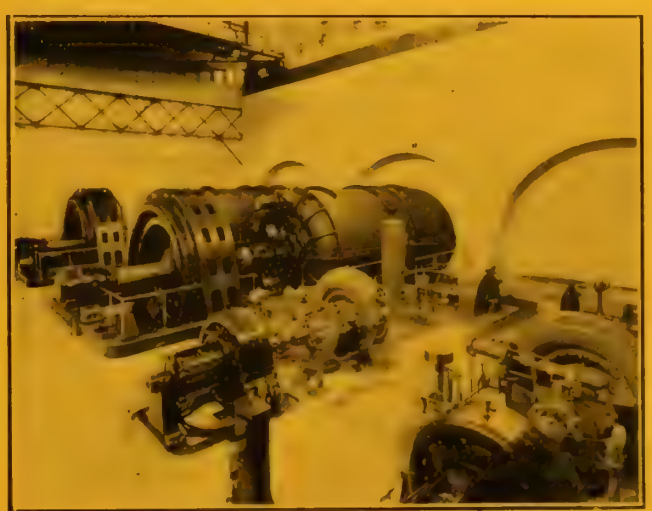

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